SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

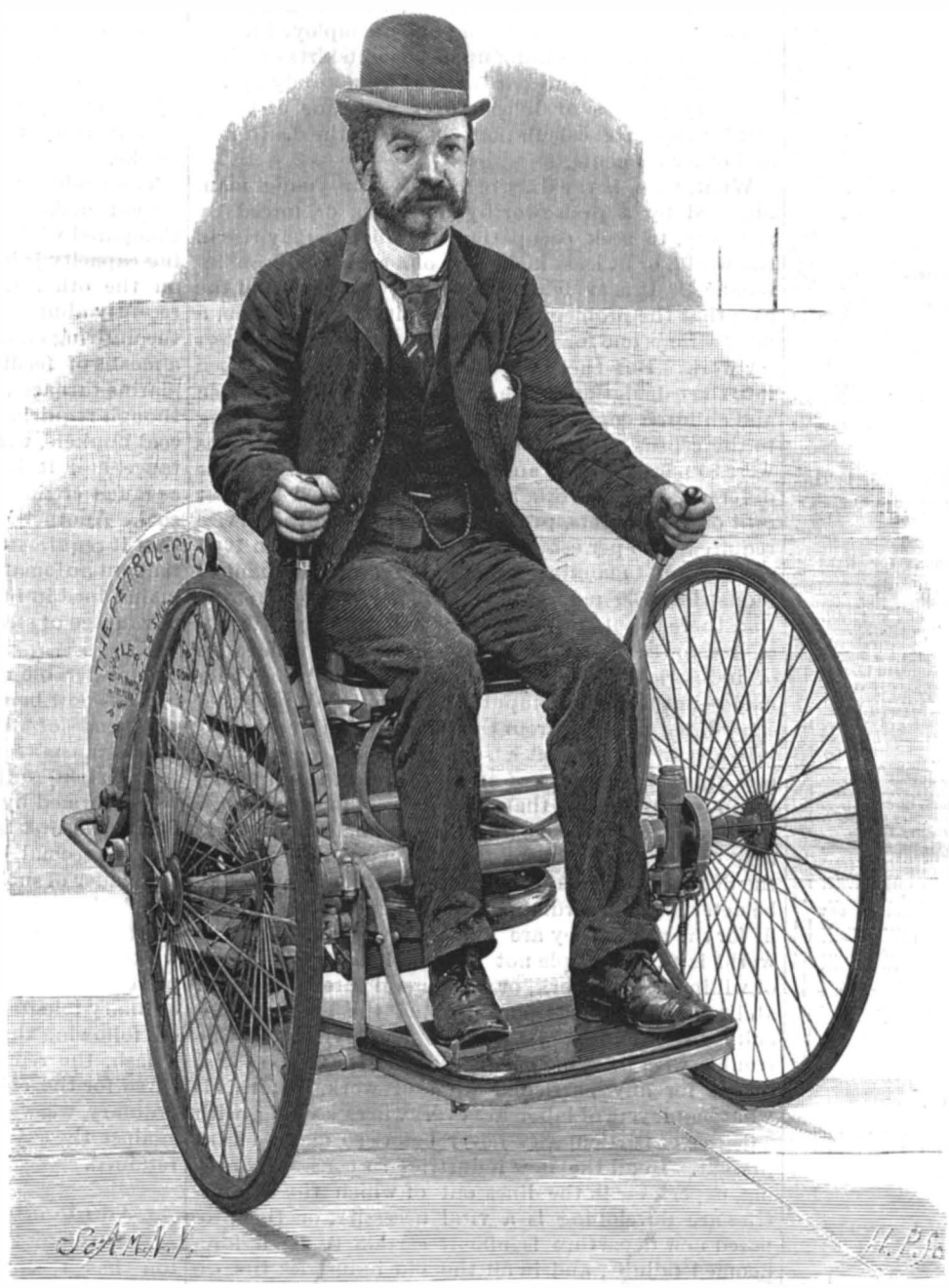
Vol. LXIV.—No. 7. ESTABLISHED 1845. | NEW YORK, FEBRUARY 14, 1891. | $3.00 A YEAR. WEEKLY.

A PETROLEUM MOTOR TRICYCLE.

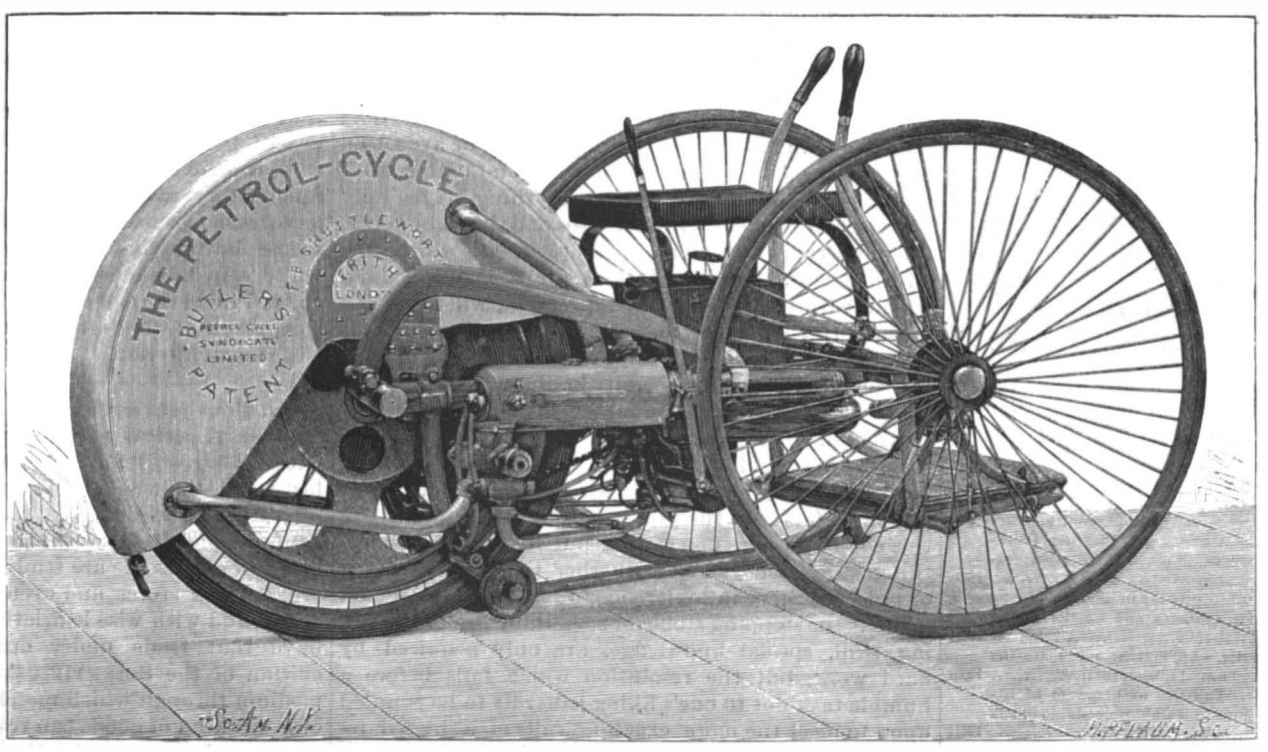
A motor suitable for propelling a light road vehicle, to carry a single passenger or two or more passengers, and which shall be light in weight, inexpensive to construct and operate, and not liable to get out of order in the hands of unskilled persons, has long been sought for. The inventors of this country, as well as those of France, Germany, England, and other nations, have brought forward many plans and combinations of devices designed to satisfy the above requirements, but in no case has a sufficient measure of success been attained to lead to any general adoption of such means of locomotion. With the more extended use of bicycles and tricycles, which have become so popular within the last twenty years, efforts have been specially directed to the adaptation of a motor to the propulsion of a vehicle of this description, the illustrations herewith representing the latest work of one English inventor in this direction, Mr. Edward Butler, of Greenwich, England.

In this machine one gallon of petroleum or benzolene is designed to furnish sufficient power to accomplish a run of forty miles, at a speed of from three to ten miles per hour. At each side is a motor cylinder whose pistons operate in the four-stroke cycle, that is, one stroke draws in the air and oil vapor, another stroke compresses the charge, which is exploded at the third stroke, and exhausted on the fourth. The pistons operate a crank shaft carried by the rear or driving wheel bearings, the hub of this wheel at one side inclosing a specially devised epicyclic gear by which the motion of the shaft is communicated to the driving wheel axle in the ratio of six to one. The shaft also carries a fly wheel, mounted to be as close as possible to the spokes of the driving wheel. The motor cylinders are each controlled by a balanced rotating valve, and both cylinders are supplied with explosive mixture by drawing air through an inspirator situated over an oil reservoir containing a supply of benzolene, or a similar petroleum product. A valve regulates the oil feed, and the mixture of air and oil spray formed in the atomizer is volatilized before distribution to the cylinders. The compressed charges are alternately ignited by an induced current of electricity passing across terminals fixed in the cylinder covers, the current being generated by a small single-fluid battery under the seat. Stopping and starting is effected by raising and lowering the driving wheel from the ground by a foot lever, the weight of this portion of the machine being then thrown upon small caster wheels. In one of the views the driving wheel is shown raised ready for starting, when the crank shaft is set in motion by a handle before the driver mounts to his seat. The speed of the motor is regulated by a throttle valve lever, shown at one side, and over-heating is prevented by water circulating through a radiating tank over the driving wheel. The tank is of 3½ gallons capacity, but with a very large proportionate surface. Steering is effected by a pair of rocking handles actuating the front wheels, which move on separate pivots, and the brake is applied to both of these wheels by a foot lever.

The diameter of the wheels is 32 inches, and the whole of the framing and the engine rods are made of oval steel tubing. The weight of the machine is 280 pounds. The arrangement of the parts is such that the motor is very compact, and it is said to be readily and easily started, the electric ignition not introducing any difficulty.



THE PETROLEUM MOTOR TRICYCLE IN OPERATION.



A PETROLEUM MOTOR TRICYCLE TO RUN FORTY MILES WITH ONE GALLON OF OIL.

The Great Siberian Railway.

The great Siberian railway, which will more closely connect Europe with the teeming millions of China, Japan, and Eastern Asia, will be commenced this spring. The total length of the line will be 4,810 miles, and the cost about thirty-two millions sterling. In case permanent bridges are built over the immense rivers Obi, Yenesei, Lena, etc., the outlay will be still greater. The commercial and political importance of this undertaking is greater than most people suppose. It will not only help to open out the immense resources of Southern Siberia, but will enable Russia to compete more successfully for the Japanese and Chinese carrying and import trade. Goods that are now sent by sea to Europe will ten years hence be carried overland into Europe, and a good deal of the Chinese carrying trade will go into the hands of Russia. A large portion of the railway will run through millions of acres of the finest virgin soil, over immense rivers, in primeval forests which have never been cut, and through countries abounding in mineral and vegetable wealth. When the line is ready it will be possible to work the rich gold, silver, iron, copper, and plumbago mines of Eastern Siberia, which have hardly yet been touched in consequence of the scarcity of labor and the absence of machinery. The rich and fertile regions of the Amoor and Usuri, which boast of a climate as fine as that of France, will then be open to colonists, and also millions of acres of land which are at the present moment almost unpopulated. By means of this railway Russia will be able to convert Vladivostock into a great naval and military station like Sevastopol, and, if necessary, pour several hundred thousand troops on the Chinese frontier in less than three weeks' time. And last, and not least, among the benefits which will accrue to mankind through this undertaking, will be the possibility of visiting China or Japan in about a fortnight from Central Europe, with all that comfort that is attached to railway traveling in Russia.—*From a Correspondent in Public Opinion.*

IMPURE or second-grade paper pulp mixed with fuller's earth makes an excellent lagging for steam pipes.

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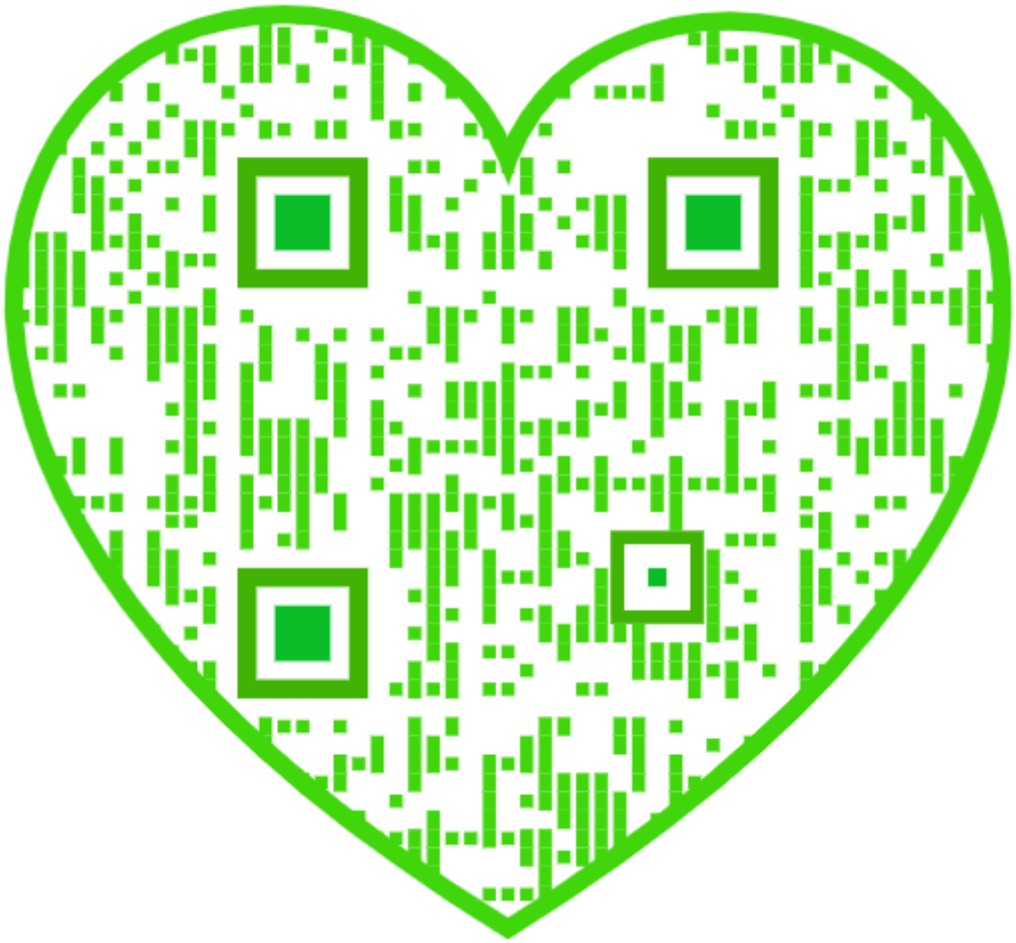

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico..... .....$3 00
One copy, six months, for the U. S., Canada or Mexico. 1 50
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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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NEW YORK, SATURDAY, FEBRUARY 14, 1891.

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LOOKING FOR EMPLOYMENT.

There are in the United States, in this year 1891, five hundred thousand seekers for work—a half million people, of both sexes and all ages, looking for employment in gainful occupations—and only 460,000 places to be filled. This is the computation of Hon. Carroll D. Wright, United States Commissioner of Labor, and formerly for many years superintendent of labor statistics for the State of Massachusetts, an authority than whom there is none higher in this branch of investigation. The figures are based upon actual returns, from the census and other sources, of the total number of persons employed at different periods, and the increase of the population, showing an average percentage added yearly to the number of persons engaged in all occupations. That is, to keep up the integrity of the work of the country—to keep it up to its full average standard of progression, and fill up the places naturally made vacant—460,000 new places will have to be filled, while the increase of the population shows that there will, in natural order, be 500,000 applicants for these places, without counting, in either case, "the great army of unemployed which through all ages has hung upon the outskirts of civilization." These figures are arrived at, not only by the ordinary process of division over a decade of years, but by separate calculations based on the death rate and other elements.

What, then, is the duty of the boy or young man, impelled by a praiseworthy ambition, or forced by necessity, to seek occupation whereby he may rise in the world, or at least make sure of a comfortable maintenance? It is evident from the bare statement of the case that the problem will be, as it ever has been, a most serious one for a large proportion of the seekers for work. But there are other elements to be taken into the calculation. The figures given include women and children engaged as well as men, and, according to the census of 1880, the employed in all occupations were 85 per cent male and 15 per cent female. In the different kinds of work, agriculture employed 44·10 per cent of the laborers, professional and personal service required 23·43 per cent, trade and transportation 10·41 per cent, and manufacturing, mining, and mechanical industries 22 06 per cent. It will be seen, therefore, that there is not only a great diversity of employments offered to the upcoming seekers for work—a wide range of industries, to which new additions are being daily made—but that the computation includes all probable candidates for work from the young of both sexes.

In a competition that is so general, among competitors urged by motives of every degree of forcefulness, it can hardly be said that there is any inexorable law which decrees that only the most fit shall survive. It may well be, nevertheless, that the manner of survival, the degree of success obtained by each, will, as a rule, be determined according as the competitors are most fit for the places they are moving forward to fill. The world is full of people not lacking in a certain degree of willingness to work, or in general intelligence and ability, but who yet appear to find the greatest difficulty in obtaining permanent employment. The trouble with most of them is that they have no special fitness for any particular kind of work, and this is what employers of labor are everywhere seeking, with a degree of particularity never before so marked as at present. In all the new industries so constantly arising, expertness in the lines out of which these industries are developing is a vital necessity, or the proposed new departure is almost certain to be a foredoomed failure; and in all the old industries the division of labor has been carried to the minutest detail, to obtain the greatest perfection in the work and the utmost economy of production. General intelligence is an excellent qualification, a mind disciplined to perceive things luminously and reason logically is of high abstract value, but in trying to obtain employment the question will be, What can you do? It does not so much matter what line of business or avocation one chooses, but the doing of more and better work therein than another matters everything. The humbler the employment, entered into with the right spirit, the more rapid as well as the more certain will be the advancement. The foundations are thus deeply laid, which, with energy and right direction, will never fail to support a solid growth.

We are constantly in receipt of letters asking advice for young men wishing to start in life in some trade or profession, but who are unwilling to do that which lies before and all around them at their hands. In most such cases it is impossible to give anything but the most general opinion, as the personal equation forms so large a factor in the problem, but there is no place in this country where one cannot put his hands to something. Do what you can, whether it is to your fancy or not—anything in preference to remaining idle—and make it the stepping stone for something better. Training, skill, special knowledge, are only acquired by hard work, but the resolution which fails before a humble task not to one's liking is hardly to be counted upon to meet the more exacting calls of a higher responsibility, and those who are wanting in the energy to do, and do earnestly, what is before them, would probably be found very illy fitted for the higher places they would like if the latter could be had simply for the asking.

Miscellaneous Notes.

Smokeless powder and the results of its use in the battles of the future are being much discussed by military men. An enemy not concealed behind works will, there is reason to believe, be under considerable disadvantage with no smoke to cover him. Especially is this likely to be the case now that the quick-firing heavy gun has been perfected. During the tests recently made at the Colt factory at Hartford the newly improved Driggs-Schroder rapid-fire gun sent a quick succession of eight-pound projectiles with unerring aim at a target four miles away. With the advance of cavalry not covered by the smoke of infantry fire till at least near to striking distance, the quick-fire gun is likely to do some terrible work, if not to make such cavalry advances altogether impracticable. Troops operating in the smoke of their own guns can often see across a field to the enemy while he cannot see them, as we can often see out of an enveloping fog bank which those at a distance cannot penetrate. Thus it is a serious question whether the use of smokeless powder by an enemy would not incline to his disadvantage, his adversary meantime being protected by a film of smoke.

The modern warship has powerful engines, but she cannot make speed, that is to say, for any distance. Compared with her engine possibilities, her coal-carrying capacity is ludicrously small. The fact is notorious on the other side of the water, and we have had recently abundant proof of it. This will account for the untiring efforts of the British Admiralty to secure a means of feeding petroleum or petroleum refuse to marine furnaces. This type of fuel, it has been found, though requiring quite as much room as the present coal bunkers, will drive the ship at least twice the distance, and it is hoped to make it yield three times as much engine-driving energy as its displacement of coal. Another highly important attribute of oil fuel is that it requires few stokers, and being to a large extent an automatic feeder, high temperatures could be maintained in furnace and boiler rooms, to the great advantage of steam making and yet without danger to life.

Considerable success is said to be attending a series of tests now being made in the navy with a new electrical code of night signals. Heretofore signals have been transmitted at night by passing a white light to the right and left over a fixed red light, the letters being formed by various combinations of the figures 1 and 2, the first being represented by the right hand and the second by the left hand movement. Unless the reader of such signals is at right angles to the line on which they are made, there is some confusion. In the present three incandescent lights are employed, red, white, and green, the same being each of 16-candle power and fitted in a vertical line on a jackstay. An ordinary telegraph key is used to show or shut them off, following the Morse system. The green light means a dash, the red a dot, the white for a space, and all three for the end of a word. For day signaling the ordinary wigwag system of two flags, a black to show against the sky and a white against the land, will be retained.

Anti-Fouling Lacquer for Ships' Bottoms.

The United States Navy Department at Washington has recently received from a lacquer manufacturer of Tokio, Japan, two plates of iron and steel respectively, each four feet square and covered with three coats of anti-corrosive and three coats of anti-fouling lacquers. These plates have been submerged in tidewater at the New York navy yard, where they will remain for three months. It is said that the Japanese navy has met with success in the use of lacquer as a protection to the hull of an iron ship, instead of paint, and an official recently returned reports very favorably on the subject. He is said to have seen a vessel on which it had been used, and whose bottom had not been cleaned in nine months, while "the lacquer was perfectly smooth and unbroken, and had afforded complete protection to the metal." The result of the tests of these plates will be awaited with much interest.

ONLY one year ago 90 per cent of the total trade of the Spanish Americas was controlled by European countries. They still have 80 per cent of it, but they are fast losing their hold and the United States is edging in. The best evidence of this is that half of the intelligent people of Mexico are studying English, while many of our people are studying Spanish. Americans are starting stores and even factories in Mexico right along, and with wise legislation to help us we will soon have that trade under our control. The Spanish edition of the SCIENTIFIC AMERICAN is an excellent medium through which merchants and manufacturers of every kind of goods can reach the best class of business people among the Spanish-speaking people of South America, Cuba, and Mexico.

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Monolithic Construction.

The buildings of the Stanford University at Palo Alto, California, have attracted wide attention by reason of their novelty, being modeled after the low, adobe, tile roof, mission buildings of the Spanish-American period. They are of stone, massive and necessarily expensive, though of great durability.

A new and striking departure is to be made in the construction of the museum, which, next to the memorial chapel, will be the most important edifice on the grounds; this building, some 300 feet in length and 50 in width, with two wings, will be three stories in height, and the entire structure from foundation up—walls, floors, and roof—is to be of concrete and twisted iron; the whole edifice to be moulded into a single monolithic structure, without seam, break, or joint.

The floors and roof will not be as massive as might be supposed, though possessed of great supporting strength. The bars of twisted iron, embedded in the mass of concrete, are immovably held at every point by the enveloping material, and thus impart their own tensile strength to the concrete, which obviates the necessity for great thickness or heavy weight, especially since it is found that bars of iron subjected to cold twisting gain largely in tensile strength by the process.

As with most simple but ingenious devices, the natural inquiry is, Why was not this mode of construction thought of before, permitting, as it does, the use of concrete where great tensile strength is required?

In the Academy of Sciences, San Francisco, these floors have projections over the central area of three feet or more, sustaining a railing and passageway for visitors, with no support beyond that of the embedded twisted bars.

There would seem to be no good reason why this method should not be widely used for fireproof buildings. The cost is found to be less than that of brick with steel beams, while the security and durability of concrete structures—if properly built—admit of no doubt.

Grate Areas.

There is no doubt that at the present time we are passing through a transition stage in all that relates to the burning of coal in locomotives. This change was introduced with the adoption of the extended front end with its straight, open stack. The abolition of cones and nettings above the exhaust nozzles allowed the use of larger openings and a slower draught upon the fire. The use in many cases of the Belpaire style of box above the frames, with its large grate area, has further increased the proportion of grate area to cylinder volume, and decreased correspondingly the depth of fire which was carried.

There are several points involved in the most economical and successful use of ordinary soft coals under these new conditions which are often not sufficiently considered. The first of these is the depth of fire that can be carried. Comparatively recent writers have commented upon the relative depth of fire that should be carried for hard and soft coal. It was formerly generally conceded that hard coal was best fired when from 6 to 15 inches in depth, while a soft fire should be carried at a depth of from 15 to 24 inches. This relation might be, and probably was, proper in the days of sharp exhausts, but with the softer blast now used it would be impossible to get a sufficient amount of air through the fire, and a thinner fire is consequently necessary. It is also a question whether we have got as far in the direction of a soft exhaust as we shall soon. Experiments with the compound engines already built seem to show that a better average performance as regards evaporation can be got with the slower blast which comes from the low pressure cylinders than with the sharper blast of the ordinary engine.

Another feature, to which more attention should be paid, is the area of air passages through the grates. The fact is too often lost sight of that the grate is merely a vehicle for carrying the fuel, and not the essential feature in the actual combustion. The object should be to have as little of it as can be done without letting the fire drop through, which latter condition has the double disadvantage of making large openings for bodies of cold air to pass through, and by filling up the ash pan allowing the grates to burn out. Smaller and more numerous openings between the fingers of the grates would obviate this difficulty. By having as free an air current as possible, with the openings approaching the neighborhood of 50 per cent of the total grate area, we can work with the slowest possible draught and a light fire. In fact, a light fire must accompany a slow draught to make any air pass through the coals. Another advantage from the slow draught is that with it the temperature immediately above the grates will not be as high, and there will be less danger of the formation of clinkers, which are so troublesome in sticking the grates. This lower temperature at the grates will make no difference in the temperature of the burning gases driven from the top of the coal. Another advantage from the slow draught is that the products of combustion passing through the tubes will give up a greater portion of their heat, and a higher evaporation per pound of coal will be reached.

The ratio of grate surface to cylinder volume is one that will be larger under these new conditions. We have seen in the past, upon one road, and in engines of different classes built at the same time, grate areas varying from 4½ to 7¼ feet to the cubic foot of cylinder capacity. The larger figure will be nearer that required in the future.

One direction in which we may have improvement in working our engines is in the character of coal used. Soft coal crushed into pieces of uniform size, well screened, gives much better results upon a fire than when broken by the fireman. It is of the right size to burn well, is free from either dust, large lumps, or impurities, and while allowing a thin fire, the air is divided into minute streams while passing through the burning fuel, so that the highest result is obtained. This crushing can be done at a small expense, and there is a good market for the increased proportion of slack or nut coal caused by such treatment.—*Railway Mechanic.*

Electricity a Factor in Capital.

"No enterprise in the world," said a well known electrician, "has increased within the last few years as rapidly as the business of electric lighting. The amount of money invested in electric light plants in this country to-day is $120,000,000, and it was only eleven years ago, you remember, that the light was first perfected. From the few lamps burned by Edison at Menlo Park, in 1879, there have grown into present use at least 125,000 arc lights and 1,700,000 incandescent lights."

One of the most noticeable results of this remarkable growth, says *Electric Power*, is the increase in the price of platinum. Here is an incandescent lamp. You see the short strip of wire attached to the copper conductor just at the top of the globe. Well, that is platinum. It connects the carbonized loop, and is one of the absolutely indispensable features of the lamp, because it expands at the same temperature and in the same proportion as the glass globe. There have been a good many experiments for the purpose of determining a substitute for platinum, but none has been found, the experiments resulting in each instance in the unequal expansion of the metal and the glass, and the consequent breaking of the globe. Unfortunately, every lamp requires a strip of this metal. I say "unfortunately" because it has come to be extremely valuable, and the mines are not productive. Moreover, they are situated in the Ural Mountains and are practically inaccessible. As a result of this increasing demand and diminishing supply, the price of platinum has advanced tremendously; it is now almost as valuable as gold. Five years ago the metal was seldom used in this country, being employed only in the evaporating stills for the concentration of sulphuric acid and in the manufacture of jewelry. It was then to be bought in the market for $3 and $5 an ounce. A year ago it advanced to $8 an ounce, six months ago it had increased to $14, and I see by one of the trade journals that it is now gone up to $20, which is only a few cents less than to-day's gold quotation.

Platinum gets its name from the Spaniards. As early as the sixteenth century it appears to have been noticed that the gold ore in the Spanish mines of Darien included grains of a white metal endowed with the qualities of a noble metal, and yet distinctly different from silver. Its exportation to Europe was prohibited, because the Spanish government found that it might easily be used in the adulteration of gold. For this reason it did not find its way to Europe until the middle of the last century, when it was known as "platina del Pinto"—the little silver from the River Pinto. Since its remarkable chemical properties were established in 1780, it has been discovered in New Granada, San Domingo, California, Borneo, and in portions of Canada. But the richest deposits are those in the Ural Mountains, where the metal was discovered in 1823, and where it has been successfully mined by the Russians since 1828.

A Large Export of Heavy Machinery.

The Gates Iron Works, of 50 South Clinton Street, Chicago, builders of rock and ore breaking machinery, recently shipped to Australia eight large rock and ore breakers having a capacity equal to 9,000 tons output per day. Four of these breakers go to the Broken Hill mine, one of the most extensive mines in the world. Upward of $5,000,000 was paid by this mine in dividends last year, and it is claimed that upward of four million tons of ore are now in sight. The other four breakers go to the government of New South Wales, where they will be used in producing rock ballast, etc., along the lines of railroad, which are there owned and operated by the government. As illustrating how easily commercial transactions are carried on with the Antipodes, it is suggestive that in less than sixty days from the time this order was placed by cable, the eight car loads of machinery were on dock in Sydney.

Opals in Washington.

A discovery of opals has recently been made near Moscow, in the State of Washington, close to the Idaho line. A number of the gems have been brought to this city and cut, showing a more brilliant play of colors than those obtained from Mexico. They are whiter and without the yellowish tinge of the Mexican gems. Some of them appear to be harlequin opals, on which the patches of color are made angular and variously tinted but evenly distributed. Others show deep green flashes of color, like those called lechosos by the Mexicans. One, a very large specimen, has been examined by a very skillful lapidary, and other competent parties, who are of opinion that it was the largest and most valuable precious opal in the rough that has been brought to this city.

The recent find was made in a wheat field where men were digging a well, and at a depth of four feet they came upon this deposit. Specimens have been shown to us by Melville Attwood of this city. Specimens of basalt wacke, the inclosing rock or matrix of the opal, came with the gems. Mr. Attwood has prepared a section of the matrix for microscopic examination, by which he identified the substance.

No special work has been done on the claim this winter, owing to the snow, so that the extent of the deposit is unknown. Some of the gems are quite large and pure; and, in fact, all of them are of very good quality and quite handsome, excelling in beauty and luster those from Mexico.

Most of the opals come from Hungary, Honduras, Mexico, and Queensland. Those from Hungary are the finest and most valuable. The Honduras mines are little worked, and the opals seldom reach the market. The opals of Mexico are well known throughout the world, although they do not rank in value or durability with those from Hungary.

It is not generally known that there are several places in the United States where opals have been found, most of them, however, small, colorless, and of little value as gems. Mr. G. F. Kunz, gem expert of Tiffany & Co., New York, in his recently published work on "Gems and Precious Stones," speaks of opal showing a brilliant play of rainbow colors, either of the noble or fine opal variety, having been observed in the United States only, near John Day River, Crook County, Oregon. The specimen found there is transparent, grayish-white in color, with red, green, and yellow flames. The play of colors equals in beauty any Mexican material, and it is the first opal found in the United States that exhibits color.

Mr. Kunz says that this strikingly resembles and has the absorptive properties of tabasheer, the variety of opal which is formed in the joints of the bamboo and which is used in India for medicinal purposes. "Undoubtedly," he says, "better material of the same kind exists where this is found."

A beautiful fire opal without any opalescence occurs in a small vein about one-fourth inch thick and two inches square from Washington Co., Ga. Common opal in small masses of greenish and yellowish white color, with vitreous luster, are found at Cornwall, Pa., also at Aguas Calientes, Gibson Gulch, Idaho Springs, Colorado, of a brownish color.

Professor William P. Blake, in his catalogue of California minerals (1866), wrote of a rich white variety of opal found at Mokelumne Hill, Calaveras Co., Cal., and on Stockton Hill, Chile gulch, opals were found in a thin stratum of red gravel at a depth of 345 feet. These stones were thought to have a market value, but really had none. A milky white variety similar to these and without fire is found 30 miles south of Mt. Diablo, Contra Costa Co., also in the foothills of the Sierra at the Four Creeks.

Nothing however with the opalescent luster and fire of these Washington opals has, as far as we are informed, been found before in the United States. As to the extent of the deposit, that is yet to be determined.

Opal is a native amorphous hydrated silica, the same mineral as quartz with the addition of six or seven per cent of water. It is never found in a crystallized form, occurring in masses having a conchoidal fracture. It has a vitreous luster, sometimes inclining to resinous or pearly, and white, green, yellow-brown or gray color, according to the foreign substances present. Hardness, 5·5–6·5; specific gravity, 1·9–2·3.

The varieties of opal are distinguished according to their color and other physical properties. Precious or noble opal, like the Washington, is generally white or colorless and exhibits a rich play of colors—green, red, blue and yellow, of various shades. When large and exhibiting its iridescence in perfection, it is a very valuable gem. Fire opal is a transperent opal colored hyacinth red to honey and wine yellow by ferric oxide; occurs at Zimapan, in Mexico. The common opal is of various colors, but without iridescence. The formation of opals is due to the solubility of amorphous silica in water, especially in hot water, containing carbonic acid, the silica being dissolved out by spring waters from decomposed silicates and deposited under favorable circumstances in a state more or less approaching to purity.—*Min. and Sci. Press.*

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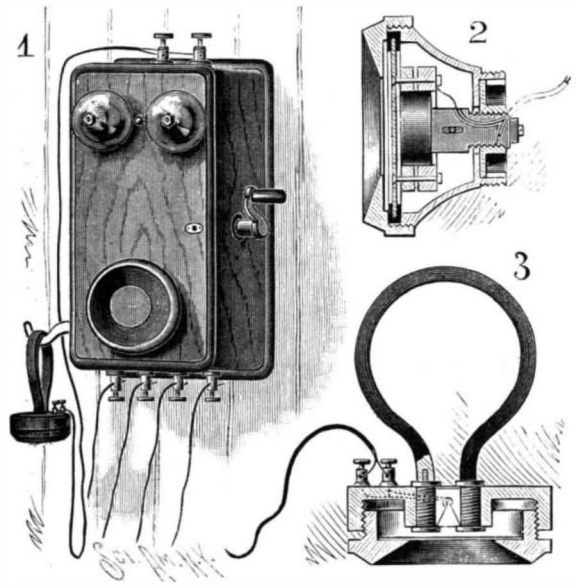
AN IMPROVED TELEPHONE.

The illustration represents a telephone designed to transmit a great volume of sound over long distances, and in which the transmitter is not liable to derangement. It has been patented by Mr. Eloy Noriega, box 516, city of Mexico, Mexico. The transmitter, shown in Fig. 2, has a diaphragm inclosed in an elastic band, annular carbon electrodes being placed upon screws passed through the diaphragm, one of these electrodes being movable upon the screws, while the other is fixed, and vibrates with the screws as they are moved back and forth by the diaphragm. A cylindrical carbon block is supported by a metallic stud to project loosely within the annular electrodes toward the diaphragm, the rear end of the stud having a threaded engagement with an insulating piece in the back of the diaphragm cell. One branch of a double conducting cord is connected with one of the screws through the diaphragm, and the other branch is connected with the stud. In the receiver, shown in Fig. 3, the mouthpiece has a laminated diaphragm formed of a number of thin sheets of iron. The poles of a polarized magnet are inserted in the diaghragm cell to within a short distance of the diaphragm, and the bobbins attached to the poles of the magnet are connected in series and their terminals connected with the binding posts projecting from the cell. Within the box, shown in Fig. 1, is a polarized vibrating bell of the usual description, and a magneto-electric machine for operating the call bells. In the cover of the box is an induction coil, the primary wire of which and the electrodes of the transmitter are in the circuit of the battery, one terminal of the secondary wire connecting through the hinge of the box with the ground wire, and the other terminal being connected electrically with one of the binding posts on the top of the box. In one side of the box is pivoted an angled lever forming a support for the receiver, the



NORIEGA'S TELEPHONE.

inner arm of the lever being connected with a spiral spring, electrically connected through a stud with one terminal of the induction coil, while in the path of the inner arm of the lever is a contact point, electrically connected with the transmitter. One terminal of the magnet of the polarized bell is connected with the ground wire and the other terminal is connected electrically with one terminal of the magneto machine, the remaining terminal of which is connected with the line wire. In using this telephone, sounds uttered in the mouthpiece of the transmitter, causing the diaphragm to vibrate, vary the contact of the annular carbon electrodes and the cylindrical electrode, and correspondingly vary the current in the circuit. The electrodes are made of binoxide of manganese, graphite, tar, sulphur, and water, formed in moulds and subjected to a strong pressure, the mass then being heated to a high temperature, in a manner similar to that followed in vulcanizing rubber.

The Famous Death Valley, Cal.

Several correspondents have called our attention to an error in the SCIENTIFIC AMERICAN of January 17, by which this desert region was located in Colorado instead of California. The name refers to one of several sections near each other, whose exact delimitations have not yet been marked upon the government maps, but which comprise some of the most unpromising lands to be found anywhere. What is known as Death Valley, and the Amargosa Desert and "sink" of the Amargosa River, are in Inyo and San Bernardino Counties, southeastern California, these desert regions also extending into Nevada, in the neighborhood of the Ralston, Mohave and Colorado deserts. For many hundreds of square miles there are only isolated farming spots, the valleys being mostly sandy desert wastes, generally terminating in an alkaline flat. According to the government survey of 1871, "the eastern slope of the Telescope Range makes an exceedingly abrupt descent of fully 10,000 feet into Death Valley, the area due east from Telescope Peak being below sea level." The information which will be afforded by a complete survey of this region, such as is now on foot, will be looked for with much interest.

The Greatest of Copper Mines.

President Agassiz, of the Calumet and Hecla Mining Company, has made the statement that, in his opinion, the mine of which he is the chief officer can be continued in existence for a period of forty years at an annual production of about double its present output. At the end of that time it may be assumed that the supply of ore upon which it depends will have been exhausted. Looked at from the present standpoint, it may seem that an output of double the present volume would be a fair and ample average of the probable future production; but when one takes into account the enormous increase that has been made in the use of copper, and the probable extension of that increase, due not only to the growth in population, but the introduction of new electrical devices of all kinds, the estimate made by President Agassiz of what the future yield of his mine will be seems a low one. We are inclined to believe that unless great changes occur, the Calumet and Hecla mine in the year 1900 will be found producing three or four times as much copper as in the year 1890. This will of course cut down the possible life of the mine, assuming the correctness of President Agassiz's estimates, and thus although large returns will be paid in the interval, we should say that in twenty-five years from this time there would be very little life left in this great mining property. The Calumet and Hecla has paid $34,500,000 in dividends.—*Boston Herald.*

The Electrical Treatment of Wine.

For some time past a small 8 horse power experimental plant, due to M. De Meritens, has been in operation at the Bercy works of MM. Pollet, where M. De Meritens' method of treating wine by electricity has been exhaustively tested and pronounced satisfactory by competent authorities. The dynamo employed is a 25 volt alternator, having a frequency of 116. The wine to be treated by electricity with a view of increasing its "keeping" qualities is passed through a small tube containing a series of silver disks connected to the poles of the alternator. The wine as it flows through the tube is thus traversed by a rapidly alternating current, which it is supposed destroys the ferments. The experimental plant is capable of treating 22 gallons of wine per hour. The process has been tried on wines of all kinds, and the results have been most marked with the light Algerian wines, whose bad "keeping" qualities have hitherto prevented their exportation.

Locks Used on United States Mail Pouches.

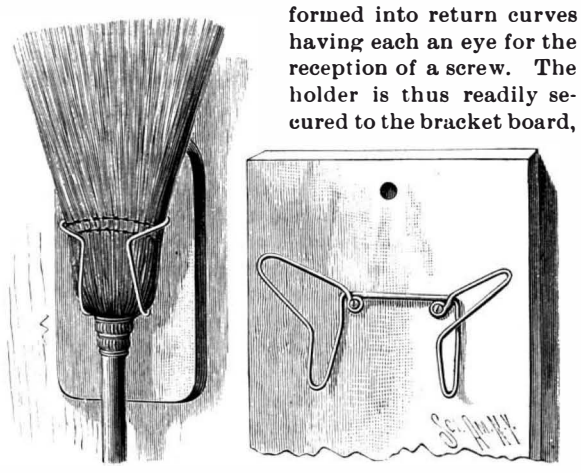
"It is a very risky thing nowadays for a mail agent to interfere with the lock on the mail pouches in his care," said Assistant Postmaster Gayler to a *World* reporter, as he handled a burnished copper lock which lay upon his desk. "This lock makes it practically impossible for any interference to go undiscovered. Examine this lock, and you will see that each time you turn the key, the register moves up one number. I lock it on the number 1,234. Now you unlock it. See, the number is now 1,235. And you cannot get it back to the first number, do what you may. All our locks begin at 1 and stop at 9,999, giving them a life of service of thirty-three years. When the last number is reached the lock will not work any more unless it is sent back to the factory and 'upset.' This fact was unknown to the route agent who ran between Altoona and Harrisburg in 1881, when the lock was first adopted by the government. He had no difficulty in procuring a key to open the lock, and figured that he could manage to go through the contents of his pouch, and by the use of a turning lathe, which he took in the car with him, he could soon send the numbers flying till he would get back to the number charged against him on leaving the post office at Harrisburg. It was mail lock No. 102, registered out on No. 23. After going through the contents of the pouch and getting a good swag he placed his lock in the lathe and commenced to turn. It didn't take very long to make 9,000 revolutions on the lathe, but when the lock refused to go past 9,999 the fellow got frightened and, throwing his booty down on the floor of the car, he jumped off and took to the woods. This was a warning to others, and we scarcely ever hear of any attempts to tackle this lock. It is the best kind of a protection against so-called honest fellows who don't mind stealing a few hundred if they risk nothing—fellows who are in positions of trust. It simply keeps watch, and if one of the men acts dishonestly, it just tells on him. That's all. But it tells every time and can't be bribed."

A Huge Gold Nugget.

At a recent meeting of the Geological Society, London, a model of the largest gold nugget yet found in Western Australia, known as the "Little Hero," weighing 330 oz. 8 dwt., found at Shaw's Fall, 200 miles from Roebourne and 80 from Nullagine, at a depth of eight inches, was exhibited by Mr. Harry Page Woodward, F.G.S.

AN INEXPENSIVE BROOM HOLDER.

A simple form of broom holder, which may be readily moved from one place to another, and hung upon a vertical support where desired, is shown in the illustration, and has been patented by Mr. J. H. Allison, of New Vienna, Ohio. It is preferably formed of a single piece of galvanized wire, or wire coated with any suitable non-oxidizable material, bent to form supporting limbs wherein the head of the broom may be seated, the middle portion of the piece of wire resting upon the face of a bracket board, while its end portions are formed into return curves having each an eye for the reception of a screw. The holder is thus readily secured to the bracket board,

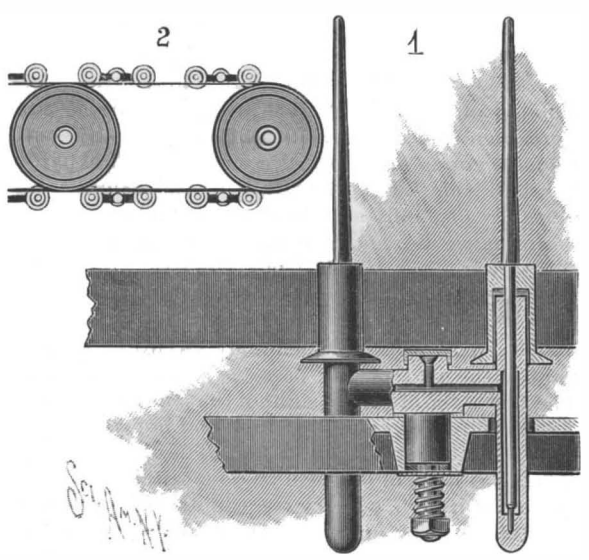


ALLISON'S BROOM HOLDER.

a hole in which permits the board to be readily hung upon a screw or nail in the wall.

A SPINDLE SUPPORT AND DRIVING DEVICE.

According to the device shown in the illustration the spindles are supported to be conveniently operated by a belt traveling across the frame of the machine, means being provided for maintaining a uniform tension on the bolsters and spindles. It is a patented invention of Mr. Joseph Duffy, No. 48 Wayne Avenue, Paterson, N. J. Figure 2 is a partial plan view, showing how the bolsters and spindles are mounted with reference to the belt, and Figure 1 is a broken vertical section, showing the construction of the bolster and the spindles mounted in it. The bolster has a horizontal body portion, with vertical arms at its outer ends in which are mounted the spindles, the extreme lower ends of the spindles being formed into pivots resting in sockets in the bolster arms. Fixed centrally to the under side of the bolster is a depending trunnion, turning in suitable bearings in the rail of the spinning frame, a depending portion of the trunnion carrying a spiral spring pressing upward against the bearing to give the necessary tension to the bolster. Upon the upper side of the bolster is a boss, having a suitable cover, and with a vertical bore communicating through a horizontal bore with recesses in the vertical arms in which the spindles are mounted, whereby oil may be supplied to lubricate the lower bearings of the spindles. Fixed to the spindles are hollow whirls fitting over the upper ends of the vertical



DUFFY'S SPINDLE SUPPORT AND DRIVER.

arms of the bolster, the lower ends of the whirls having lateral flanges adapted to support a belt, by which the whirls and spindles are rotated. The spindles are so arranged in the frame that the belt will press firmly against the whirls, and motion will thence be transmitted to the spindles, the oscillating of the trunnion causing an even pressure to be brought upon both whirls of a bolster, thereby imparting the same speed to each spindle and the same twist to the yarns. This device is also designed to double the capacity of each pulley, as, by means of the oscillating bolster, each pulley drives eight spindles, each of which bears with an even pressure upon the belt, thereby imparting an even twist to all the yarns spun.

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The "Potato Cure."

Readers may remember the article which went the rounds of the various medical journals about a year ago, which highly extolled the virtues of potatoes as a remedy in cases where foreign bodies had been taken into the stomach. The explanation of this lay in the fact that the potato leaves a large residue in the intestine which passes on and increases the amount of fæces to a considerable extent; the foreign body is enveloped in this, and any sharp corners or angles which it may possess are kept from injuring the delicate mucous membrane of the stomach and intestines. To accomplish this end large quantities of the vegetable must be eaten, and potatoes are given in every conceivable form, fluids being avoided as much as possible. The foreign body thus passes out without injury to the alimentary canal. At the time this remedy was brought to general notice several cases of recovery by its use were also noted. As the idea appears to be a very sensible one, we take occasion to abstract from the report of a case, remarkable in some respects, which was recently published in the *Medical Record*.

The case is reported by Dr. Edward Pisko, of New York, and is that of a child not quite one year old, who had swallowed a screw one inch in length. The screw passed on into the stomach, and did not seem to be giving much trouble when the patient was first seen. To avoid both a laparotomy and the danger of intestinal perforation, the aid of the potato was invoked, in spite of the tender age of the patient and the fact that it had just been weaned from the breast. Potatoes were given in every form, and white bread dipped in milk, but no fluids. The child continued well, and on the fifth day, after the administration of a slight laxative, the screw was passed enveloped in fæces. There was no apparent injury to the stomach, and no intestinal catarrh, and the child's general health remained unaffected. The interesting features of the case are the brilliant success of a most unassuming remedy and the fact that the patient was so young, and scarcely weaned.

Pisko also relates the following case, which he saw in Albert's surgical clinic at Vienna:

A boy æt. 6 years, who, two years previously, had swallowed a nail, which at that time was removed by gastrotomy, was brought there again with a nail (6 centimeters long) in his stomach. This time the "potato cure," which had been introduced in the meantime, was used, with the result that on the ninth day the nail made its appearance per *vias naturales*.

It would seem that we are not yet acquainted with all the possibilities of the luscious tuber, since it even bears off the palm from laparotomy.—*Weekly Medical Review.*

Death Rates of the World's Largest Cities.

Following are the vital statistics for a number of the principal cities of the world, compiled to December, 1890:

	Estimated Present Population.	Annual Death Rate per 1,000.
AMERICAN.		
New York	1,655,598	22·22
Baltimore	455,427	19·31
Boston	446,507	23·64
Brooklyn	853,985	22·41
Chicago	1,100,000	16·93
District of Columbia (Washington)	250,000	. . .
New Orleans	254,000	48·48
Philadelphia	1,064,277	18·97
San Francisco	300,000	20·23
St. Louis	460,000	15·02
FOREIGN.		
London	4,421,661	21·1
Liverpool	613,463	21·9
Birmingham	461,865	18·5
Manchester	379,437	27·2
Glasgow	530,208	22·4
Dublin	353,082	25·5
Copenhagen	307,000	20·7
Christiania	143,300	20·7
Stockholm	236,350	18·0
St. Petersburg	924,466	24·7
Amsterdam	403,083	19·2
Rotterdam	197,723	18·6
Antwerp	232,418	26·1
Brussels	182,275	25·7
Paris	2,260,945	24·61
Rome	393,496	23·9
Venice	156,515	31·5
Berlin	1,575,485	17·1
Munich	298,000	30 2
Prague	314,425	21·99
Vienna	822,176	23·0
Buda-Pesth	442,787	. . . .
Bombay	773,196	19·78
Calcutta	433,219	21·5
Madras	398,777	35·0
Cairo	374,838	34·8

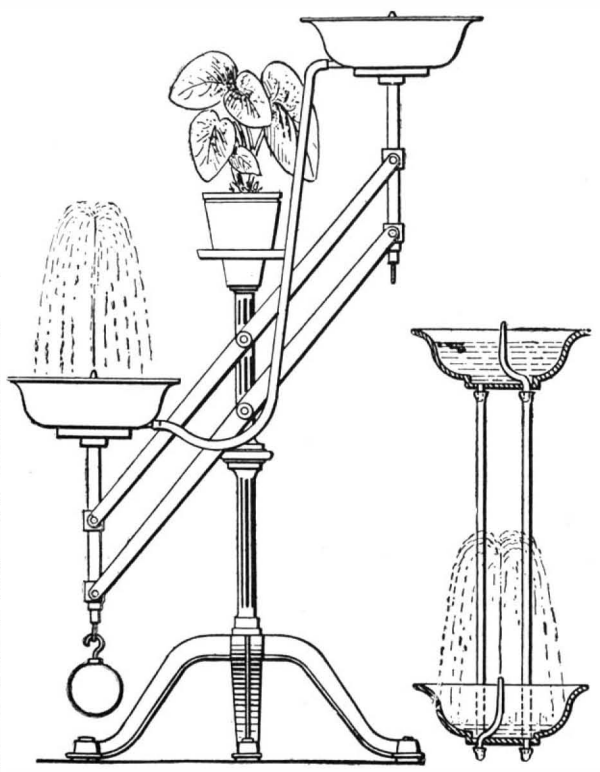
—*Fire and Water.*

Estimated Population for 1900.

The estimate of the population of the United States for the year 1900, by Hon. Carroll D. Wright, superintendent of the Department of Labor, gives as the approximate figures 76,639,854. This is the result of a careful consideration of the estimates made by several other reliable individuals, the known rates of increase, and the various circumstances that bear upon the growth of population.

PORTABLE PARLOR FOUNTAIN AND FLOWER STAND.

The annexed engraving, taken from the Vienna *Gewerbe Zeitung*, illustrates a fountain consisting principally of two equal sized basins, each containing a spraying nozzle and an outlet pipe, the spraying nozzles being connected by two rubber pipes with the outlet pipes, as plainly shown in the sectional view.



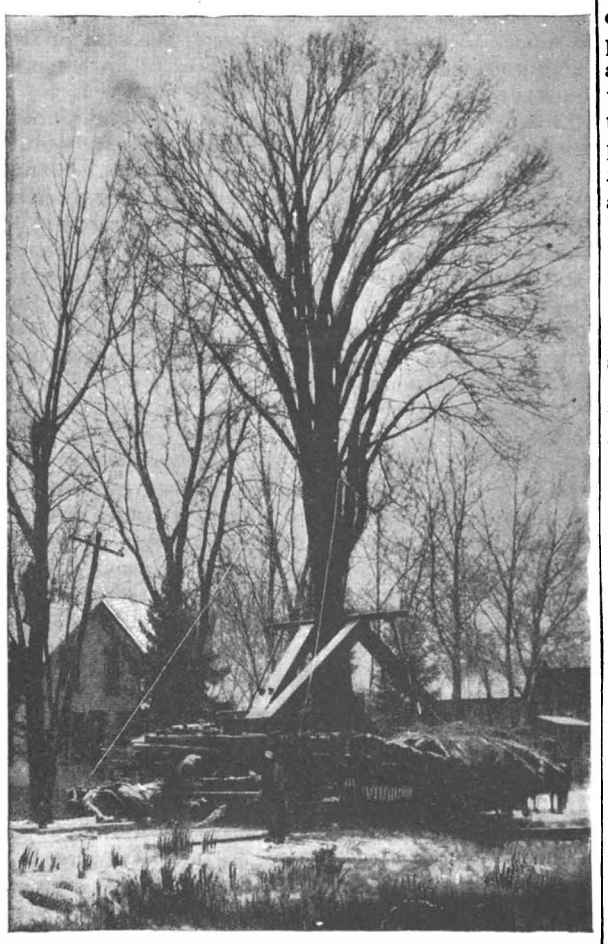
PORTABLE PARLOR FOUNTAIN AND FLOWER STAND.

The basins are supported on suitable holders connected with each other by parallel levers fulcrumed on the flower stand. A weight is adapted to be hung on the lower end of the holder containing the empty basin to counterbalance and to hold the filled basin in an uppermost position. The water flows from the filled upper basin through the outlet pipe to the spraying nozzle of the lower basin, and is projected quite a distance up into the air, to fall back and gradually fill the lower basin. When this is accomplished, the upper basin has run empty and the counterbalancing weight is now hung on the holder of the empty upper basin so as to change the position of the levers, and consequently the basins; that is, the filled basin assumes an uppermost position, while the empty one swings downward. The water now flows from the upper basin to the spraying nozzle of the lower empty basin, and is sprayed to accumulate in this basin.

It takes about one hour's time to empty a basin containing about one-half gallon of water, the opening of the spraying nozzle being one-half millimeter in size.

In case the water gets dirty, the basins can be readily removed from their holders and emptied, cleaned, and replaced, and one again filled with fresh water.

T. G. H.



A CURIOUS TOMBSTONE.

Subterranean Fires.

Some idea of the terror of volcanoes may be gathered from an account of an eruption in one of the Hawaiian islands, as graphically described in the *London Budget*, when the crater was filled from five hundred to six hundred feet deep with molten lava, the immense weight of which broke through a subterranean passage of twenty-seven miles and reached the sea, forty miles distant, in two days, flowing for three weeks and heating the water twenty miles distant.

Rocks melted like wax in its path; forests crackled and blazed before its fervent heat; the works of man were to it but as a scroll in the flames.

Imagine Niagara's stream, above the brink of the falls, with its dashing, whirling, madly raging waters, hurrying on to their plunge, instantaneously converted into fire—a gory-hued river of fused minerals; volumes of hissing steam arising; smoke curling upward from ten thousand vents, which give utterance to many deep-toned mutterings and sullen, confined clamorings: gases detonating and shrieking as they burst from their hot prison house; the heavens lurid with flames; the atmosphere dark and oppressive; the horizon murky with vapors and gleaming with the reflected contest.

Such was the scene as the fiery cataract, leaping a precipice of fifty feet, poured its flood upon the ocean. The old line of coast, a mass of compact, indurated lava, whitened, cracked and fell. The waters recoiled and sent forth a tempest of spray; they foamed and lashed around and over the melted rock, they boiled with white heat, and the roar of the conflicting agencies grew fiercer and louder. The reports of the exploding gases were distinctly heard twenty-five miles distant, and were likened to a whole broadside of heavy artillery. Streaks of the intensest light glanced like lightning in all directions; the outskirts of the burning lava as it fell, cooled by the shock, were shivered into millions of fragments and scattered by the strong wind in sparkling showers far into the country. Six weeks later at the base of the hills the water continued scalding hot and sent forth clouds of steam at every wash of the waves.

A New Industry for Sunderland, England.

The negotiations which have been taking place for some time past between the River Wear commissioners and the Anglo-American Oil Company have at length been brought to a satisfactory conclusion, and, before long, a new and very extensive industry will be established in Sunderland. The Anglo-American Oil Company is one of the largest concerns in this country or America. It owns large oil wells in Pennsylvania, besides a fleet of specially constructed steamers for the conveyance of oil across the Atlantic. The company intends to erect works at Hendon, near Sunderland, covering about two acres of ground, which will comprise three or four tanks resembling gasometers in appearance, for the reception of the oil. The liquid will be pumped from their own ships, as they arrive in the docks, to the tanks referred to, and thence dispatched to all parts of the kingdom. This is an entirely new industry in the port of Sunderland, and capable of assuming large proportions.—*London Times.*

A CURIOUS TOMBSTONE.

The inhabitants of the sleepy village of Wilmette, Ill., were astonished not very long ago to find an enormous elm tree standing in the middle of their principal street. It had been moved along the highroad, and was being conveyed to Graceland Cemetery, where it was to be planted over the grave of Mr. J. H. Lathrop, of Chicago. A rather romantic story is told about the reason for the transportation of so large a tree. It was said that while Mr. Lathrop and a friend were out shooting about two years ago, they stopped to take lunch under the spreading limbs of an enormous elm. They stood admiring the tree, and finally entered into a compact that upon the death of either, the tree was to be transplanted to the grave of the deceased at the expense of the survivor. Unfortunately, there is no reason to believe that there is any truth in the story, as Mr. Lathrop was not a sportsman. He knew the tree, took a fancy to it, and made up his mind that he would be buried under its branches. To that end he provided a fund of $10,000 in his will for the removal of the tree from the forest where it stood to the cemetery, a distance of twelve miles. At the time when the photograph which we publish was taken, the tree had been moved five miles without accident, save the sad fate which met one of the laborers, who was crushed to death beneath it. A force of thirteen men is employed, and the expense of removal so far has been $2,000.

A hole has been chiseled through the tree about ten feet from the ground, and through this has been passed a steel bar, which projects far enough on either side to bear upon the heavy timber braces which support the tree in an upright position. Wire guy ropes are attached to staples driven in the limbs which serve as a further support. The roots are carefully wrapped up to protect them from freezing. The tree is about 75 feet high and 7 feet in circumference.

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Pasteur's Treatment for Rabies.

Considerable discussion has been had among medical men, at home and abroad, as to Pasteur's preventive method for hydrophobia, it being alleged as highly probable that in many instances patients have undergone treatment when the dog which had inflicted the bite was quite healthy, or, at least, not suffering from rabies. But Dr. Tomkins, medical officer of health, Leicester, England, relates in the *Lancet* the following record of three cases treated at the Pasteur Institute last year, which places beyond all doubt that the animal, at the time of inflicting the injuries, was suffering from rabies:

On January 8, 1890, a stray dog came into the borough of Leicester from the adjoining suburbs, and on its way bit two school children, a boy and a girl, on the face and hands, the wounds upon each of the children's faces being of a very extensive, lacerated character. This occurred outside the borough boundaries, and almost at the same time it bit also a small terrier dog. Continuing its course into the town, it bit a young man severely on the hand, and shortly after this it was killed. The patients were seen by medical men and the wounds cauterized, but not until after the lapse of some little time. In one case nearly an hour elapsed. I saw all the patients on the following day, and, with the assistance of Mr. Fraser, the veterinary inspector to the corporation, made a post mortem examination of the dog. The pathological appearances to the naked eye were practically *nil*, but the stomach contained some pieces of straw and other debris. The cord and medulla were removed.

On Saturday, the 11th, I took the three patients to Paris (taking with me the cord removed from the dog), and on Sunday morning they were seen by M. Pasteur, and treatment commenced in the usual manner. From the cord several rabbits were inoculated, and before the end of a week these succumbed to what M. Pasteur declared to be rabies. The man was kept under treatment fourteen days, but the two children, owing to the severity of the wounds, were kept for twenty-five days before being sent home. The small terrier bitten by the dog was kept by me under close observation shut up, away from all other animals, and on the fifteenth day from being bitten it began to show signs of indisposition (having in the interval been apparently in good health), which soon declared itself as undoubtedly rabies, and the animal succumbed on the third day from the first onset of the symptoms. Being kept secluded and alone, it showed but few signs of excitement, but crawled about, refusing to eat or respond when called to, paralysis of the lower jaw and hind limbs soon supervening. It should be noted that the wound on its hind leg was but a small one, not larger than a threepenny piece, and at the time of its death was healed.

Here, then, we have indisputable evidence that the animal which bit these three patients was suffering from rabies, and the probabilities are, seeing how easily the second dog was infected, that at least one or other of the three would have developed symptoms of hydrophobia if the treatment for prevention had not been adopted. As more than twelve months have now elapsed since the occurrence, and all of them remain in good health, we may conclude they have now quite escaped from any untoward consequences.

New Signals for Our Cruisers.

The new French system of signaling at night at sea was put on the cruiser Chicago before she sailed, for experiment during her cruise this winter. Ten lamps hang vertically from a backstay; a keyboard having sixty-two different characters, letters, and signals governs the lamps, and in this way the combinations are made. This system of signaling is at present used in the French and German navies. Various other systems are being experimented with by American officers to find one which is best. The present system on American vessels, according to the New York *Tribune*, consists of three 16 candle power electric lights—one red, one green, and one white—which hang vertically on a jackstay, several feet apart. The Morse code of signals is used, and an ordinary telegraph key does the work of flashing or shutting off the light. The green light indicates a dash, the red light a dot, and by flashing the lights in this way signals may be sent over a distance, depending upon the clearness of the night, but not usually over three miles. Experiments are also being made with the electric search light. The plan is to throw the light overhead, making dashes and dots against the sky, so that a whole fleet could read them for many miles around.

Bombay Water Works.

A huge dam has been designed to inclose the watershed of the valley which drains into the sea south of Bombay. It is two miles long, 118 feet in height and 103 feet wide at the base. The roadway on the top is to be twenty-four feet in width, and the stonework will cost half a million sterling. The lake of water which this dam will imprison will be eight square miles in area. Twelve thousand Hindoos trained to this special work are employed on the dam.

Stickstoffwasserstoffsaure.

At a recent meeting of the New York Academy of Sciences, Dr. H.C. Bolton spoke briefly on the remarkable addition to chemical knowledge recently made by Prof. Th. Curtius, of Kiel, viz., a new strong acid called in German "stickstoffwasserstoffsäure"—in English *hydrazoic acid*—having the formula

$$HN_3;\ \text{or, } H-N\begin{cases}N\\ \|\\ N\end{cases}$$

Curtius obtained it in several ways, the most convenient method being by converting hippurylhydrazin into nitrosohippurylhydrazin, and decomposing the latter with alkali.

$$\underset{\text{Nitrosohippurylhydrazin.}}{C_6H_5CONHCH_2CO.\ N\begin{cases}NO\\ NH_2\end{cases}} = \underset{\text{Hippuric acid.}}{C_6H_5CONHCH_2COOH} + \underset{\text{Hydrazoic acid.}}{HN\begin{cases}N\\ \|\\ N\end{cases}}$$

The new acid is a gas, having a frightful suffocating odor, irritating the mucous membrane and producing headache. It is very soluble in water, yielding a strong acid solution, like hydrochloric acid. This solution dissolves iron, zinc, copper, aluminum, and magnesium, with liberation of hydrogen and formation of nitrides of the metals. With salts of silver and mercury white precipitates are formed resembling chlorides of these metals, but the silver compound is not blackened by light; the mercurous, copper, and ferrous salts are explosive.

Advantage is taken of the insoluble silver salt to prepare the acid in a pure state; boiled with dilute sulphuric acid it yields hydrazoic acid. An aqueous solution containing 27 per cent of the gas is much heavier than water, and sinks to the bottom of the vessel into which it is poured. The solution yields white clouds with ammonia, just like hydrochloric acid. Prof. Curtius plans to build up an entire new series of nitrogen compounds of greatest interest to the chemical world.

Dr. Bolton spoke of the great importance of the discovery of the new strong acid from industrial, analytical, and physiological points of view.

Poisoned by Hothouse Flowers.

The poisoning of several greenhouse workmen by contact with some greenhouse plant was noticed in our columns the other day. The name of the plant was not mentioned, but we suppose it must have been the Chinese primrose, that is technically known as *Primula obconica*. This primrose is one of the most beautiful of the genus, and it is now in full bloom in our conservatories and offered for sale in the florists' shops. Its poisonous character is well known to experienced florists. After handling it they are apt to be affected with an inflammation of the skin of the hands and arms, and often of the face, of an eczematous type.

This lovely little plant is a native of central China, where it was first discovered by Mr. Maries, a botanical collector, who sent seeds of it to England. Plants raised from these seeds bloomed for the first time in Europe in September, 1880. In the following year it was figured and described in the *Botanical Magazine*, and three years later a colored plate of it appeared in the *Garden* newspaper. It created a sensation in European gardening circles, and on account of its easy growth, neat habit, and winter blooming nature, and the great profusion and beauty of its blossoms, it has found much favor with English and Continental florists.

As it seeded and multiplied very freely, it soon found its way to this country, where, till two years ago, it was a reigning favorite both in private and commercial gardens. When its poisonous nature, however, became generally known, its popularity received a decided check; but it is such a beautiful little plant that even now cultivators dislike to give it up altogether.

The whole plant, leaves, petioles, and flower stems, is covered more or less thickly with jointed hairs, and it is supposed that these hairs cause the poisonous irritation by breaking off and entering the skin of the hand. But all who touch the plant are not poisoned by it. We know of workmen who can handle it with absolute impunity at any time, while others are always susceptible to its evil influence. The back of the hands, between the fingers, and the bare arms are the parts affected; the hard palm of the hand escapes uninjured. The face and eyes of some workmen are also poisoned by it, although these parts never touch the plants. One person whom we know of can handle the leaves without any smarting pain, such as the stinging of a nettle, and no pricking as if a cactus hair had penetrated the skin; but after an hour or two the itching begins, and lasts more or less for several days. In fact, the effect upon the skin presents a good deal the appearance of parsnip poisoning, but it is never so virulent or so lasting as that caused by poison ivy.

The explanation that was given that "the only way in which one could account for the poison was that Paris green and some other powders that are used in the hothouses to kill vermin must have adhered to the flowers after they were cut," is quite unsatisfactory. Paris green is not used, we believe, as an insecticide in greenhouses. Tobacco, either in the form of powder or vapor, or smoke, is employed to destroy aphides and thrips, but tobacco is harmless to the skin. Sulphur is used against red spider and mildew, but it is harmless to the hands.

Pyrethrum powder, known also as Dalmatian insect powder or buhach powder, is employed more or less, but it is not injurious to touch or taste; only in breathing when it is suspended in the atmosphere is it hurtful. Other insecticides than these are seldom employed by the busy florists who supply the cut flowers for the New York market.—*N. Y. Sun.*

The Earth's Interior.

One of the most interesting questions relating to the earth considered as a planet is that of its interior constitution. Observations made in deep mines and borings indicate that the temperature increases as we go downward at the average rate of one degree Fahrenheit for every fifty-five feet of descent, so that if this rate of increase continued, the temperature at the depth of a mile would be more than one hundred degrees higher than at the surface, and, at the depth of forty miles, would be so high that everything, including the metals, would be in a fluid condition. This view of the condition of the earth's interior has been adopted by many, who hold that the crust of the earth on which we dwell is like a shell surrounding the molten interior. But calculations based upon the tidal effects that the attraction of the sun and moon would have upon a globe with a liquid interior have led Sir William Thomson and others to assert that such a condition is impossible, and that the interior of the earth must be solid and exceedingly rigid to its very center. To the objections that the phenomena of volcanoes contradict the assumption of a solid interior it is replied that unquestionably the heat is very great deep beneath the surface, and that reservoirs of molten rock exist under volcanic districts, but that taking the earth's interior as a whole the pressure is so great that the tendency to liquefaction caused by the heat is overbalanced thereby. The whole question, however, is yet an open one. According to the nebular hypothesis, which assumes that the bodies of the solar system once existed in a nebulous form and by gradual condensation and loss of heat have attained their present condition, it is probable that the earth is still slowly cooling off, and that, as we see it, it represents an intermediate stage between the hot vaporous globe of a planet like Jupiter and the cold and barren moon. If we accept this theory—and it is yearly gaining strength—then the habitable period in the earth's career appears to be but one chapter in its varied history. When it was yet molten and vaporous it could not support life, but it shed light like a star. Now it possesses a cool and solid crust on which innumerable tribes and species of animal and vegetable life swarm and flourish. Anon it will become cold and inert, its waters and its atmosphere retreating into its interior, and with them the life that depends upon their presence will disappear. This possible cause of the cessation of the life-supporting energies of the earth, it will be observed, is independent of the withdrawal of the light and heat of the sun, an ultimate catastrophe to which we have heretofore referred.—*Prof. Garret P. Serviss, in the Chautauquan for February.*

Electrical Street Car Propulsion.

We are informed by Mr. D. H. Bates, vice-president and general manager of the Accumulator Company, that a contract has been made for the equipment of the new G Street branch of railroad, Washington, D. C., with six storage battery cars. This railway company was one of the first street car roads in the United States to adopt electricity as a means of propelling its cars, and the Thomson-Houston system of trolley wires was installed there several years ago. Congress, however, will not permit the railway company to erect any more trolley poles, particularly in the heart of the city, and this storage battery system has been adopted.

The Edco system is the invention of Mr. W. W. Griscom, the president of the Electro Dynamic Company, of Philadelphia, the initials of which title serve to form the word "Edco." The cars are being manufactured by the J. G. Brill Company, of Philadelphia, and will be lighted by electricity, equipped with the Edco system of motors and gearing, the gearing running in oil, with dust-tight covers for motors, and with a number of "23 M" type accumulators, designed to give an average speed of 8 miles an hour and a maximum speed, when desired, of 15 miles an hour.

Riches of Oregon.

There is a tract of forest trees in Southern Oregon, embracing about 16,000 square miles, which, if cut and sold at $10 per 1,000 feet, would pay our national debt twice over. It is estimated that the amount of merchantable timber standing amounts to 400,000,000,000 feet.—*Oregonian.*

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Correspondence.

Smokeless Powder Formula—a Correction.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 10 I read this chemical formula for the composition of the smokeless powder: $10\ C_3H_5(ONO_2) + 9\ C_6H_7O_2\ OH(ONO_2)_2$, forming the products, $58\ CO + 26\ CO_2 + 61\ H_2O + 48$ N. Mol. W. = 4538. Now, I suppose there is some mistake in that.

1st. 26 CO_2 should be 26 CO_2, and then the Mol. W. will be 4538. No gas CO_3 exists I believe, but CO_2 is common.

2d. $C_3H_5(ONO_2)$ is meant, I suppose, for nitro-glycerine, which is $C_3H_5(ONO_2)_3$, or $C_3H_5(NO_3)_3$.

The other compound, $C_6H_7O_2.OH(ONO_2)_2$, may be the *binitro* cellulose, or a mixture of the three, thus: $3\ C_6H_7O_2(NO_3)_3$, trinitro cellulose; $3\ C_6H_7O_2.OH(NO_3)_2$, binitro cellulose; $3\ C_6H_7O_2(OH)_2(NO_3)$, mononitro cellulose; could be resumed in $9\ C_6H_7O_2.OH(NO_3)_2$. Therefore it seems to me that the formula should be written thus: $10\ C_3H_5(ONO_2)_3 + 9\ C_6H_7O_2.OH(ONO_2)_2$, with a Mol. W. of 4538. The decomposition products are 58 CO + 26 CO_2 + 61 H_2O + 48 N.

PROF. C. H. JOURDAN.

Seton Hall College, South Orange, N. J.

Indexing Notes and Queries.

To the Editor of the Scientific American:

In the issue for January 10, under query No. 2689, a subscriber asks how he may be able to index the "Notes and Queries." As I, too, regard them as highly valuable, it has been for some time my custom to index them. For a number of years I have been in the habit of indexing all my periodicals as well as the books which I have read, from the principle that it seems a waste of time to read, in general, what is not of permanent value and may not be wanted again for future reference.

As the method which I have employed has proved satisfactory, and is simple and cheap as well, I give it for the benefit of other readers. It is somewhat more detailed than the one suggested in the reply to the query.

Procure three-quire blank books of convenient size, with record ruling. Cut the margins for the letters of the alphabet, as in an index to a ledger. Allow six pages to each letter, with the exceptions of J and Z, for which four will be sufficient, and there will remain two each for Q and Z. Index successively these six pages with the vowels in order. This will leave one blank page for miscellaneous additions.

To use it, select the leading word in the article and find its initial letter in the margin, and the first vowel following the initial will indicate the page for entering the reference. W. M. STINE,

Prof. Physics and Chemistry, Ohio University.

Athens, Ohio.

What is the Temperature of Ice?

Authorities differ widely upon this question. A careful investigator recently made some experiments looking to a solution of this and has sent us the following:

January 23. Atmospheric temperature + 40° F.

(1) In a block of inferior ice, full of bubbles and fissures, an auger hole was bored 6 inches deep. In the cavity thus formed a chemical thermometer was dropped, the borings being used to pack the orifice around the instrument. When fifteen minutes had elapsed, the temperature within the ice was found by aid of a lens to be + 30·5°.

(2) Equal parts of ice and salt being mixed in a wooden pail, they formed a solution at the bottom, in which the thermometer read —10°. In the center of the pail a quart tin cup was placed, nearly full of filtered water. The cup was supported above the bottom of the pail, and in it was suspended a second chemical thermometer, while the water was allowed to freeze into a solid mass around it.

In thirty minutes the water in the cup was converted into ice. At the end of an hour and a half the relative temperatures indicated by the two thermometers have not varied, and now read, respectively: That in the freezing mixture, —50°; that in the ice in cup, 0°. These readings were taken in the office, where the temperature was 74°.

Both thermometers were carefully compared with a valuable standard instrument and with each other, before and after the experiments, and their readings were corrected for variation at different points.

Progress of the World's Fair.

Plans for the government buildings have been completed in Washington. The buildings, which will be nearly square, will cover nearly 150,000 square feet, and have a main entrance and ornamented arcade resembling the Arc de Triomphe at Paris. In the middle a handsome, pagoda-like tower will rise, beneath which will be a great rotunda. The building will cost $400,000, and $1,000,000 will be spent on the exhibition and in its annexes. The government buildings at the Centennial cost only $80,000.

How Newspaper Pictures are Made.

The illustration of newspapers is a new branch of art. Ever since its beginning its apprentices have been trying to find out the simplest and most effective methods for the reproductions of drawings, in order that they might be made with the greatest possible quickness, engraved on metal with the utmost attainable celerity and printed clearly and well at the rate of twenty thousand copies per hour. To such perfection have the processes for this purpose been brought, that the turning out of pictures all ready for the lightning presses is nowadays hardly more than a matter of a few minutes' time.

Most interesting of the processes employed in newspaper illustration, from the point of view of simplicity, is what may be termed the "chalk method." Take a thin bed of smooth chalk laid upon a metal surface, and draw upon it with a fine steel point any picture you may desire. The steel point will cut the lines of the picture out of the chalk to the metal, and thus you will have it in the shape of an intaglio. Make a stereotype from this intaglio, and you have your metal plate to print the picture from. Could anything be more simple?

DRAWING ON A BED OF CHALK.

Such is the idea of the chalk process. In applying it, instead of pure chalk various mixtures are used, such as plaster of Paris, which is merely chalk in another shape, with a certain proportion of a white Carolina clay. The stuff, pulverized and stirred up with water, is spread over a rectangular sheet of polished steel, as you would spread a slice of bread with butter, to an even thickness of about one thirty-second of an inch. Now you are ready to begin operations as soon as you have baked the steel plate in an oven for a while, until the chalk layer has been rendered perfectly hard.

It will hardly do for you to attempt to draw your picture directly upon the chalk, lest you make mistakes. The best way is to make your sketch on a piece of paper, and then laying it down upon the chalk surface, go over the lines with a pencil point, which will indent the paper, and leave marks beneath upon the chalk. Lift the drawing, and you find under it, in the chalk, its reproduction. Now you apply your steel point directly to the chalk, cutting all the lines of the drawing down through the chalk to the surface of the steel plate. When you finish this operation the dark steel of the plate shows through the chalk in all the lines of the sketch. And these lines are perfectly clean and sharp, thanks to the keenness of the knife-like steel point employed. All you have to do for the rest is to pour molten lead over the chalk surface in a mould and let it get cold. The lines that are cut out of chalk will be reproduced in relief upon the lead, and thus you will have your metal engraving to print the newspaper picture from, mounting it for the purpose on an iron block, thick enough to make it level with the type.

ZINC ETCHING.

Though so advantageous for its simplicity, the chalk method is not so good for fine work in the way of sketches and portraits as the "zinc process," so called. The former, however, by reason of its cheapness, is most useful to provincial newspapers, which cannot afford comparatively expensive photographic plant required by the latter. In the zinc process, to begin with, an ordinary photograph reduced to the required size is taken with a camera of the pen and ink sketch drawn on cardboard by the artist. Next a smooth plate of zinc is "flowed over" with an albumen solution that forms a sensitized skin on the surface. The glass negative of the picture is laid upon this zinc plate and the two are put together in the sunlight. What are to be the black lines of the printed drawings are, of course, white and transparent in the negative. The sunlight goes through wherever the negative is transparent, and has the effect of hardening the sensitized skin beneath, so that it clings tightly to the zinc. It requires only one minute to perform this operation. Now the zinc plate is taken and given a coating over the sensitized skin of lithographer's ink, rubbed on with a roller, after which the plate is washed. In all places where the sunlight has not struck the zinc, owing to the opacity of the glass negative, the sensitized skin readily washes off, together with the ink that covers it; elsewhere it clings. Thus, after the washing, the perfect drawing in ink remains upon the zinc plate. To make the ink lines harder the plate is brushed with powdered dragon's blood. Then it is plunged into a bath of acid, which eats away the zinc wherever it is not protected by the ink, so that when it is taken out the lines of the drawing are found all raised above the rest of the surface of the plate, like a map for the blind, and when mounted "type high" on a metal base, you have your "cut" ready to print from.

Such is the zinc process. "Processes" have infinitely multiplied within the last few years—so much so, in fact, that the student of engraving is aghast at contemplating their variety. At present, however, the zinc method seems to be the most available for journals of the period. At all events, it is employed by a majority of the big newspapers of the country.

A THIRD PROCESS

considerably used for newspaper illustration is that of photo-engraving, which somewhat resembles the zinc method. A glass plate, however, is used instead of a metal one. This glass plate is covered with a thin layer of sensitized gelatine, which is permitted to dry. Then the photographic glass negative of the drawing, made with the camera, just as in the other case, is laid over the gelatine, and the glass plate and negative, with the gelatine layer between them, are put in the sun for half an hour. The light hardens the gelatine, and makes it cling to the glass plate wherever it strikes through the negative, so that when the glass plate is subsequently put into water, all the rest of the gelatine comes off, leaving the drawing on the glass in gelatine lines. Moist plaster of Paris is spread over the plate next and permitted to harden. When it is taken off it is a mould of the drawing. From this mould a plaster "relief" is made, and a reproduction of metal in this relief by stereotyping is the plate to print with.

These are the three methods by which newspapers produce the pictures which go so far to brighten up and help out the interest of the columns of the daily press.—*Washington Star.*

The Strength and Weight of Aluminum.

The following interesting data concerning the strength and weight of aluminum are abstracted from a paper by E. Hunt, J. C. Langley and C. M. Hall, read before a meeting of the American Institute of Mining Engineers, and copied into *Fire and Water.*

Bar 1 in. square, 24 in. between supports loaded, at center with
Load of 50 pounds deflected $\frac{3}{64}$ in., permanent set, $\frac{2}{64}$ in.
Load of 150 " " $\frac{11}{64}$ " " $\frac{13}{64}$ "
Load of 200 " " $\frac{17}{64}$ " " $\frac{12}{64}$ "
Load of 300 " " $2\frac{13}{64}$ " " $2\frac{5}{64}$ " not ruptured

Taking tensile strength of aluminum in relation to its weight, it is as strong as steel at 80,000 pounds ultimate strength.

Metal.	Weight of 1 cut ft. in pounds.	Tensile strength per square inch.	Length of a bar able to support its own length.
Cast iron	444	16,500	535 feet.
Ordinary bronze	525	36,000	9,893 "
Wrought iron	480	50,000	15.000 "
Hard struck steel	490	78,000	23,040 "
Aluminum	168	26,000	23,040 "

Aluminum 97 to 99 per cent silicon (graphitic) 0·10 to one per cent silicon combined 1·90 to 2·80, and iron from 0·40 to 0·20 per cent. The averages are as follows:

Elastic limit per square inch in tension	(Castings)	= 6,500
Elastic limit tension	Sheet	= 12,000
Elastic limit tension	Wire	= 16,000
Elastic limit tension	Bars	= 14,000
Ultimate strength per square inch in tension.	(Castings)	= 15,000
Ultimate strength tension	Sheet	= 24,000
Ultimate strength tension	Wire	= 30,000
Ultimate strength tension	Bar	= 26,000
Percentage of reduction of area, in tension	Castings	= 15 p. c.
	Sheet	= 35 p. c.
	Wire	= 60 p. c.
	Bar	= 40 p. c.

The Tænicide Properties of the Cocoanut.

Professor Parisi, of Athens, some time since called attention to the tænicide properties of the cocoanut when freely ingested. His attention was drawn to the subject from an accidental experience in his own case. It was while he was traveling in Abyssinia that one day he took a considerable quantity of the nut, sufficient to produce an attack of diarrhea. After a while, much to his surprise, with one of these diarrheal motions there came away a complete tænia, head and all, and quite dead. After his return home to Athens he made some observations in this line of treatment and reported an almost invariable success. In only one instance did he fail to secure the head. His method was to order the milk and pulp of one cocoanut to be taken in the morning, fasting, no purgation or cessation from business being required. In this country Dr. Allison has reported, in the *Medical Age*, a case where the use of *Filix mas*, oil of turpentine, and chloroform had successively failed to effect a complete removal of the parasite, but in which the patient by chance partook of a cocoanut and soon after was relieved of a dead tapeworm with its head. Since then he has had occasion to prescribe cocoanut in this trouble, and has found it the pleasantest of all the tænicides, and one that does not require the administration of a cathartic.—*New York Medical Journal.*

Black Polish on Brass.

To make a dead-black polish on brass, for microscopes, etc., mix 1 ounce of nitrate of silver in a dish with 20 ounces of distilled water. In another dish mix 1 ounce of nitrate of copper with 20 ounces of distilled water. Mix the two solutions together, dip the brass in the liquid, remove the brass, and heat in an oven until the desired degree of black is obtained.

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CONCURRENT ELECTRIC REPORTS OF RACES.

The illustration and diagram on this page show the method of working of an electrical system by means of which new electro-mechanical results are obtained which are novel and interesting from the electrician's standpoint. This system has been worked out by Mr. S. D. Mott, of Passaic, N. J., whose system of bulletining baseball games was described in the SCIENTIFIC AMERICAN of January 24, 1891.

The dial of this instrument may represent anything in the nature of a race. In this case a horse race is shown. Referring to Fig. 2, the transmitting part of the apparatus is shown at A, which consists of a positive and negative key, the operator's index and a battery. In the line at the receiver is the neutral relay, *n*, and the polarized relay, *n'*, one giving a uniform step by step motion to hand cylinders or disks controlled by ratchets, *rr'*, actuated by magnets, *mm'*, etc. The other relay selects the magnet in the instrument to show, in this case that of a horse race, the number of the races, as at *a*, to start horses and at the same time tap a bell, as at *b*, to show the winners in colors marked on bristol board disks, as at *c*, or acting to accelerate by magnets, *dd*, etc., or to retard, by means of a neutralizing coil on *mm'*, etc., any contestant selected by the operator at A, through the medium of the selector, C, and polar magnet, *n'*. This diagram for convenience shows only two contestants, with their respective magnets, but it will be readily understood that more may be added in the full line circuit, *e*, and that they may be placed in series as shown, or in parallel. The resistance, *t*, will equal the sum of the resistance of all the actuating magnets less one. This equalizes the magnetizing and demagnetizing current from the battery, neutralizing its effect on *m* for instance when the current is split at *s*. There is no need of synchronism as ordinarily understood; the fact that the contestants all come together and stop on the scratch after each event insures indentity of action in all instruments for all practical purposes.

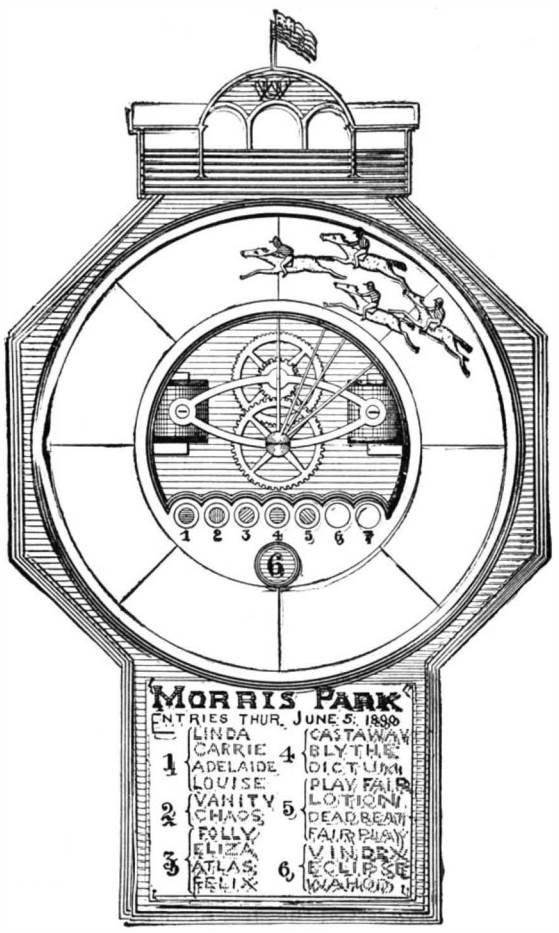

1 2 3 4 5 6 7
6
MORRIS PARK
ENTRIES THUR. JUNE 5. 1890
1 LINDA CARRIE ADELAIDE LOUISE
2 VANITY CHAOS FOLLY
3 ELIZA ATLAS FELIX
4 CASTAWAY BLYTHE DICTUM
5 PLAY FAIR LOTION DEADBEAT FAIR PLAY
6 VINDEX ECLIPSE WAHOO

Fig. 1.—THE DIAL.

Fig. 1 is an ornamental dial showing the relative positions of the horses in a race from start to finish. A bulletin is supplied with the day's entries, and when so supplied will play any race when connected electrically with the track or course.

The horses' names are generally printed in colors to correspond with dummies on dial; upon the entry card may also appear any information, such as sweepstake or handicap, the purses, the ages, best records, names of jockeys, etc. The dummies are also colored so that in each race the identification of the dummy is complete. At the opening in the dial above the figure 6, which is the number of the race being run, are disks indicating the winners. When the race starts, a bell is tapped or a music box may be set playing to attract attention. The horses all come in in the proper order, ready for the next race. The dial is now exhibiting a race taking place at Morris Park, Thursday, June 5, 1890. The winner of the first race was Linda, 2d Chaos, 3d Atlas, 4th Castaway, 5th Fairplay; the sixth is just ending with Vindex the winner and Eclipse 2d. It will be apparent that the dummy horses may be replaced by colored arrow heads or even letters or figures for other races, such as yacht, boat or foot races. The advantages of this system from an economic standpoint, and quite apart from its popular and attractive aspect, are that no receiving operator is necessary; the dials name and publish the event at one and the same operation, one operator taking the place of 100 operators when a game or race is being reported from the grounds to 100 different localities. In comparison with the stock ticker, it is much cheaper to make, simpler in mechanism, and by no means as liable to derangement or error in working. It can be operated over single line circuits to greater distance than any ticker, needing no attention, such as supplying with tape, winding, etc., only an occasional inspection by those having them in charge. An important point in connection with this invention is its capacity of being relayed or operated over long lines, operated from New York to Chicago for instance. Instruments used at Cleveland could be actuated by relays interpolated in the line. The same is true for other intermediate points. Signals are wholly unintelligible if the line is tapped.

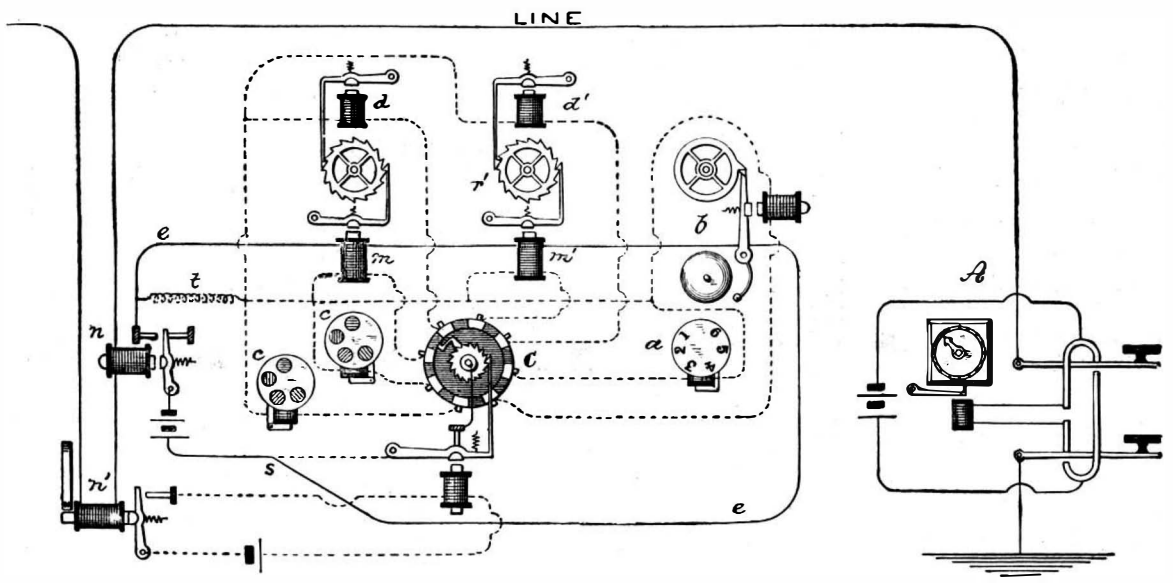
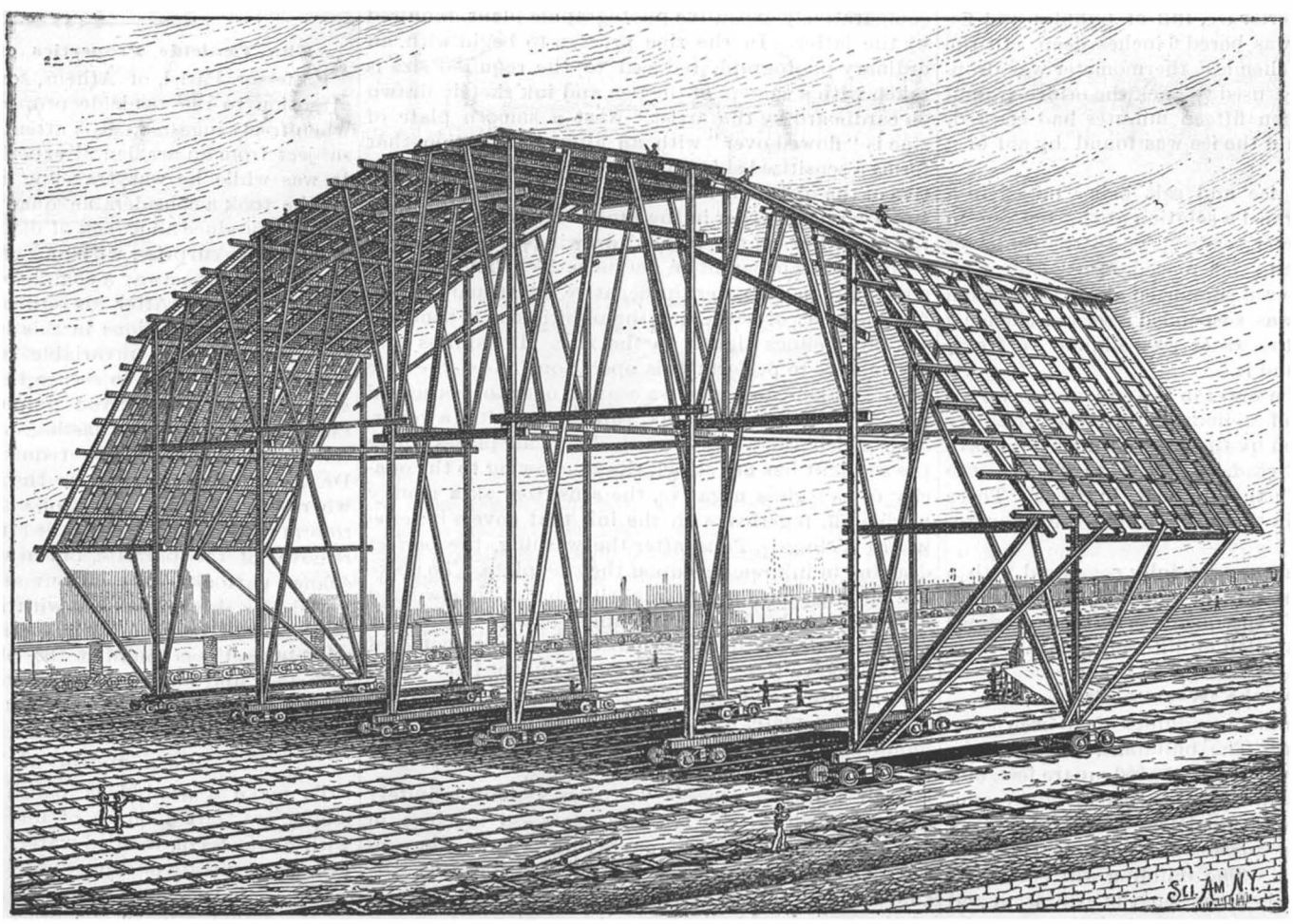


Fig. 2.—CONCURRENT ELECTRIC REPORT OF RACES.

NEW DEPOT OF THE PENNSYLVANIA RAILROAD.

Very few people appreciate the great work of reconstruction that has been begun at the eastern terminus of the Pennsylvania Railroad system at New York and Jersey City. The present accommodation for trains and for passengers has been found to be inadequate, and active operations have been begun for remedying the evils of the old system. Among these evils are the delay and dangers attendant upon the running trains through the streets of Jersey City on the road level. This is to be altered, and the tracks all through the city are being elevated upon the most substantial sort of substructure, one that can carry the heaviest express trains at full speed. The saving in time will be considerable, besides relieving the railroad company from many suits for loss of life and limb. The necessity for this is apparent. Jersey City has become too important a municipality to endure any more the ceaseless passage of trains through her streets and across her thoroughfares. The Pennsylvania Railroad is the largest road entering the city limits, and the city will be greatly benefited by this disposal of its trains. The Pennsylvania Railroad will reap the benefit of an exclusive track free of all crossings, upon which trains can freely run at high speed directly into the terminal station.

This elevated viaduct will operate in perfect harmony with the double deck ferryboat system which is soon to be put into active operation on the lines across the Hudson River, connecting Jersey City and New York. The passengers will be transferred directly from the platform of the depot to the upper deck of the ferryboat, while the local traffic will be confined to the lower deck of the boat. This relieves the ferryboats from the great overcrowding which formerly took place during the busy portions of the day. A ferry house with a double landing will also be provided at the New York shore, and the passengers on the two decks will disembark on separate platforms of the ferry house. The upper platform on the New York side connects with a bridge extending across West Street, which enables passengers to reach the foot of Cortlandt Street without having to wade through the mud which is almost always to be found in these overcrowded thoroughfares. The



TRAVELING SCAFFOLD USED IN ERECTING THE TRUSSES OF THE PENNSYLVANIA R.R. DEPOT IN JERSEY CITY, N. J.

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bridge is now in course of erection, and will be found of great convenience to passengers.

The terminus of the railroad proper is in Jersey City, N. J. The company are there engaged in the construction of an immense passenger depot, which when completed, it is claimed, will be the largest structure of the kind in the country. Up to the present time but a very small portion has been erected. A high level area for the floor has been established by filling in, the sides being laid up with old sleepers in crib-work. Brick foundations for the great frames are completed, and the bases of many of the frames are in place.

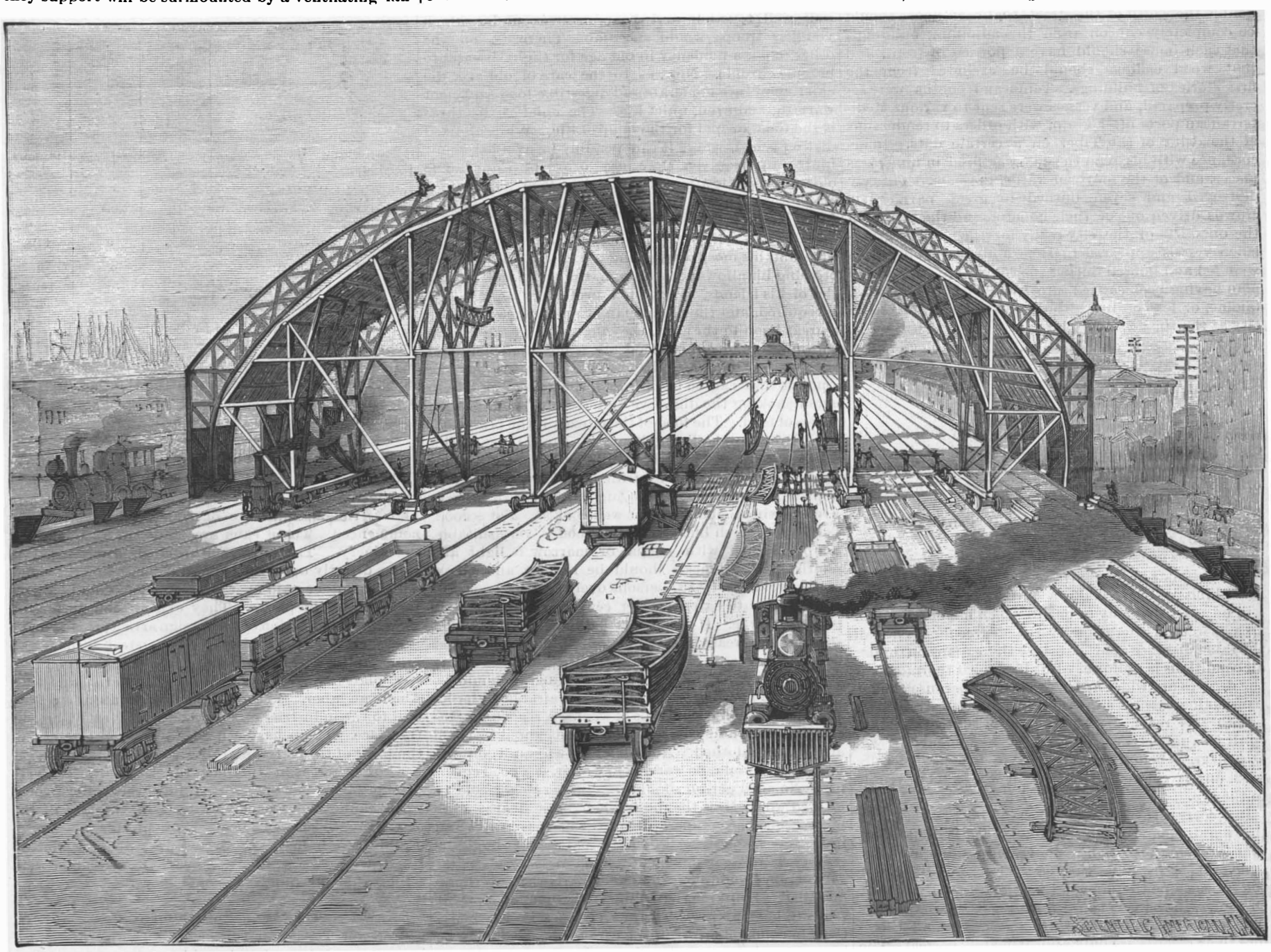
The general plan of the depot involves the roofing of a clear area of 256 by 600 feet with metal and glass, carried by twenty-two arched trusses. These are arranged in pairs, the members of each pair being 14 feet 6 inches apart, and 43 feet 6 inches intervening between each pair. This gives a total of 58 feet from the center line of one pair of trusses to the center line of the next pair. These trusses, with a clear span of over 250 feet, will rise 90 feet from the ground level, and the structure they support will be surmounted by a ventilating lantern or clear story 26 feet high. The bases of the trusses rest on eight steel rollers at each end, and these bases are connected by a tie rod or extension member made of 12 inch I-beams, spliced end to end. These extend clear across the depot, under the level of the tracks.

The depot will provide eight outbound and four inbound tracks, with wide passenger platforms between.

For erecting the arched trusses a traveling scaffold has been constructed, which is illustrated in the cuts. It is carried by twelve railroad car trucks, running upon six tracks. A 12 by 14 inch beam, 60 feet long, is carried by each pair of trucks, running on the same track. An iron plate resting on the truck bolster receives the end of the beam, which is prevented from shifting, if it had such a disposition, by dowels. Into the end of each of these stringpieces a vertical member, 12 by 14 inches, and a diagonal member of similar size are mortised. There are no intermediate supports. Upon the twelve upright and twelve diagonal members thus provided the arched or hip roof top of the scaffold rests. The general construction is shown clearly in the cuts. The timbers are bolted together and braced diagonally, with an entire absence of tie rods. Ladders are fixed for ascending to the first hip of the roof. At a number of places going up the slopes of the roof, cross slats are nailed to act as ladders. Two inch planking is distributed over the roof, so as to provide a good working platform. Small cranes are set up on the hips and ridge to raise the pieces of the trusses. The hoisting is done by portable hoisting engines standing on the ground.

The scaffold is 234 feet wide, 60 feet deep, and 84 feet high. Thus it is deep enough to include three trusses. When these have been set up, the hoisting cranes are taken down and the scaffold is shifted a distance of 58 feet, bringing it into position for the erection of three more trusses. It is moved by the hoisting engines. It is found that it moves very quietly, without oscillation, and without much strain. In one case, when the wheels were unskidded, the great structure moved a couple of feet under the influence of the wind alone.

The timbers are generally 12 by 14 inches and 12 by 12 inches, of Oregon pine. Some of them are 80 feet long. There is only one spliced timber in the whole structure. There are about 120,000 feet of timber in it, costing $40 per thousand. The whole cost is put at $8,000. The total weight is in the neighborhood of 400,000 pounds. The work is being executed by the Pennsylvania Railroad. It is under the superintendence of Mr. A. Brann.



ERECTING THE GREAT TRUSSES FOR THE DEPOT OF THE PENNSYLVANIA RAILROAD, AT JERSEY CITY.

As a standard of comparison, the great train room of the Grand Central Depot in New York may be taken. This is 652 feet long by 199 feet 2 inches wide, and 94 feet high, and is similar to the Pennsylvania Railroad depot, being covered by a roof carried on arched trusses.

The Schiseophone.

London *Iron*, noting that the importance, both in mechanical and civil engineering construction, of having metal free from internal flaws has always been recognized, and the difficulty of detecting them as well, records an approach to a solution of this difficulty by means of the schiseophone, which is the invention of Captain De Place, of Paris. "This apparatus consists of a small pneumatic tapper worked by the hand, and with which the piece of steel or iron to be tested is tapped all over. Connected with the tapper is a telephone with a microphone interposed in the circuit. Two operators are required, one to apply the tapper and the other to listen through the telephone to the sounds produced. These operators, who are in electrical communication, are in separate apartments, so that the direct sounds of the taps may not disturb the listener, whose province it is to detect flaws. In applying the system one operator places the telephone to his ear, and so long as the sounds produced by the taps are normal, he does nothing. Directly a false sound—which is very distinct from the normal sound—is heard, he instantly signals for the spot to be marked. By this means he is able not only to detect a flaw, but to localize it."

Mortality from Snakes and Wild Beasts in India.

The latest official statistics on the subject show that in 1882, 22,970 persons were killed in India by snakes and wild beasts, as well as 76,271 cattle. Of the former number, 20,571 deaths were due to snake bites, 975 to tigers, 184 to leopards, 139 to wolves, 110 to bears, 57 to elephants, and the remainder to other animals (scorpions, dogs, foxes, crocodiles, lizards, wild boars, etc.). The curious feature of the figures is that, in spite of all the efforts made to destroy snakes and other animals, and the sums paid as rewards for this purpose, the mortality both of persons and cattle is increasing. It is suggested that the most effective method will be to destroy the cover for snakes near the villages, and district officers are accordingly ordered to see that this is done, while the local governments are left to decide for themselves whether the reward system is to be continued or not. The provinces most seriously affected are Bengal, Oudh, and the Northwestern Provinces.

The Distances of the Stars.

It is quite a familiar illustration to represent the distance of the stars in terms of the *light-year*, but it has not been noticed that the same figures which express in years the time light occupies in reaching the earth from a star will also express in miles the distance of the star upon a scale of the radius vector of the terrestrial orbit to the inch. The illustration appears useful, as it gives, perhaps, a more distinct idea of the isolation of the solar system in space than can be otherwise obtained, and does not introduce the question of time into the measurement of distance. Thus if the annual parallax of 61 Cygni is assumed to be 0".434, which is probably very nearly correct, it will take 7½ (7·464) years for its light to reach the earth, and 7½ (7·499) miles will represent the distance of this star on a scale that gives one inch to the distance of the sun from the earth.—*John I. Plummer, Nature.*

THE United States has a mile of railway for each 400 of population and each 22 miles of area, while the balance of the world has a mile for each 7,500 of population and 227 miles of area.

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The Great Fire in Rome, A. D. 64.

It has for centuries been commonly understood that Rome was set on fire and burned by the Emperor Nero, in the year 64, either through brutal malice or drunken incapacity and indifference. Another account of the matter has lately been given, as the result of the recent investigations of Lanciani, an Italian author, as follows:

Nero desired to make many changes in the streets of Rome by increasing their width and making many of them more direct, and also to introduce many improvements by reconstructing public buildings. His efforts in this direction were met by an opposition from property owners, and were also embarrassed by the fact that the city abounded in temples, altars and shrines which were inviolate.

The emperor directed two architects, Severus and Celar, to prepare plans for the rearrangement of streets in certain parts of the city, making them as near to straight lines and right angles as the hilly configuration would render feasible. Numerous public squares were laid out, and a system of sewers planned. Regulations for buildings were prepared, in which it was provided that the height of houses should not exceed double the width of the street, that each house should be completely cut off from the adjoining buildings, that each house should have a portico in front, and that wood ceilings should be excluded from the first stories of buildings. Tents and booths were secretly prepared, and vessels were sent to various Mediterranean ports after grain, with orders to rendezvous at the delta of the Tiber on a certain date. In accordance with his plan the city was fired in numerous places, and of the fourteen wards, three were entirely destroyed and seven burned in great part. The crowds driven out of their homes found the booths in the outskirts of the city ready for them. The grain-laden vessels appeared in time, and the townspeople were fed and housed during the rebuilding; the whole plan having been carried into effect without exposure, famine, or loss of life, although the population of the city at the time was very large.

Something about Thermometers.

The aperture in the tube of a thermometer is smaller than the finest hair. And though it appears to be round, it is not, for if it were, the mercury could not be easily seen. It is, therefore, made flat, and then the glass magnifies it so that it seems to be quite large. To bring it out still more distinctly, a maker of Boston recently conceived the idea of backing the tube with a thin film of white sizing. This device is now generally adopted by the foreign makers.

Mercury is generally used in thermometers because it is more regular in its contraction and expansion. It is indeed impossible to make a spirit thermometer that will be as trustworthy as one in which mercury is used. In a mercurial thermometer the degree marks are all the same distance apart, because the expansion under all conditions is uniform. But in a spirit thermometer the degrees are wider apart at the top, because the expansion increases at a greater ratio after a certain temperature is reached. Though not so trustworthy, spirit thermometers are necessary, as mercury freezes at 40 degrees below zero. Spirits of wine is generally used, and is colored red, so that it will be more visible to the eye.

In a correct thermometer, the scale is graduated to the requirements of the tube to which it is fitted, so that every correct thermometer must have a special scale of its own. That is to say, it wouldn't do to put the tube of one thermometer in the frame of another. Of course, in the very cheap grades of thermometers such accurate adjustments are not made, and therefore their records are only approximately correct. The best thermometer tube made will cost about $5; but a thermometer may be made to cost almost any price, according to the way in which it is mounted.

As every one knows, the Fahrenheit scale is that most commonly used in this country. Fahrenheit arbitrarily assumed a limit of cold which he termed zero. This makes the freezing point 32 degrees above zero and the boiling point 212 degrees above zero. As a matter of fact, however, in northern latitudes the temperature in winter frequently falls below the zero point, so that there is no scientific reason why the zero point in the Fahrenheit scale should be where it is. A much more scientific scale is that known as the centigrade, which marks the point at which water freezes as zero, and divides the space between that and the point at which water boils into one hundred degrees. In the Reaumur scale zero marks the freezing point, and eighty above zero the boiling point. Many self-registering thermometers are now used. These instruments mark the highest or lowest temperature reached, as the case may be, so that one may return at night feeling assured that the weather can play no pranks without his learning of them.

IN the stables of the Adams Express Company, Boston, a five horse electric motor operates two machines for grooming horses. With the new machines two men can groom a horse in five minutes.

The Science of Old Age.

Old age has its special dangers and its special safety with regard to disease. For instance, whereas in a child the temperature goes up on the slightest provocation, in old age it can hardly be moved at all. The aged body is not, as a rule, prone to any acute disease. If a person passes eighty, it is rare for him to be seized with any special malady. In injuries such as fractures, though from the lightness and brittleness of the bones they are easily met with, they are repaired solidly and quickly, even in centenarians. Slight shocks cause severe depression, but greater injuries are surmounted, and surprising recoveries made from severe maladies. Wounds and ulcers often heal quicker than in the young; the aged recover from attacks of congestion, paralysis, apoplexy, pneumonia, erysipelas, and other affections in a surprising way. Diseases, as we have said, often pass them by. A man may live to one hundred in a house in which he had typhoid fever himself, and in which many of his children and grandchildren have since died from it. It is probable these favorable results are due to the long time the organs have worked unitedly and helped each other, like old soldiers who pull well together and bear reverses under which younger troops would succumb. There is, on the other hand, a tendency in old age for slight diseases to become chronic. Now, as to the care of old age, the chief points are moderate and digestible food, sufficient warmth, and even, quiet life. The chief of the three is the food, or fuel for the lamp of life. While all fixed dieting is bad, where it can possibly be avoided, a few hints can be given that may prove of value. The older a person is after fifty, the less food he requires. Luigi Cornaro, who lived to one hundred, though of a feeble constitution, took 12 ounces of solid food and 14 ounces of fluid daily during the latter part of his life; and his most severe illness was caused by his increasing his allowance, through the continual entreaties of his friends. Very little proteid or animal food is required, and though in many respects false teeth are a great boon to the aged, they may lead to too great a consumption of animal food. It is not the amount of coals we put in a grate that warms the room, but the amount that can be burnt; and the great point is to avoid choking the digestive and excretory organs with excess of food. The food of the nursery is the best in old age. Bread and milk and honey is a capital diet. Milk agrees with nearly all. Hot milk with a little Mellin's food forms an admirable drink at night, and can be kept warm in a hot water jug covered with a cozy. Fruit is wholesome if ripe or well cooked. Fat is good, as cream or fresh butter. Warm food is very suitable. Soup enriched with cream or marrow is light and nourishing. All meals should be regular, and all excesses avoided. Of 800 persons over eighty, 60 per cent were moderate eaters, 30 per cent small, and only 10 per cent large. If weight is being gained, the diet should be decreased. In addition to the after-dinner nap as years creep on, a doze after breakfast and before dinner is often helpful. As to clothing, it should be both warm and light. Fur is an admirable material. The underclothing should be of wool. A sealskin waistcoat is useful, and the feet and hands should be well and warmly clothed. And eider down quilt on the bed, which should be warmed in winter, is a good covering. No aged person should be suffered to get cold in bed. Two A. M. is the hour when most deaths take place, when the temperature of the body is lowest and its powers feeblest. All habits of old people should be respected, and not lightly altered. Whatever excites exhaustion should be forbidden. Early rising is therefore bad. Drinking hard water is not good, as it tends to hasten the calcareous changes in the body. Certain common errors in the care of the aged may be here pointed out; some we have already touched on.

1. That the aged require rich and very nourishing diet.
2. That early rising is good for them.
3. That cold baths invigorate them; whereas they are fraught with imminent danger, and are often fatal.
4. That continual medicines and dinner pills are needed to digest the food; whereas, instead, less should be eaten.
5. That the rooms should be hot; whereas they should be cool, but not cold—65 degrees to 70 degrees.
6. That a fixed diet should be rigidly adhered to; whereas variety is often essential.

Old age is of two sorts: that which is natural, and that which is prematurely acquired in youth; and it need hardly be observed that it is only of the former variety we now speak. Self-denial often requires to be practiced by the aged in many ways, though not arbitrarily. All known weak points in the constitution should be jealously watched. No care as a rule surrounds the aged such as guards the young, because they are not in many ways the same objects of interest. But this is not as it should be, nor is it consistent with the Christian profession. In animals, death when it comes is, as a rule, swift. There is, with the vast majority, no old age and debility suffered among them. No long wasting or disease or slow tumors embitter their lives; they are killed by their fellows when their powers fail, and are thus delivered from all these slow tortures by one sharp stroke. This apparent cruelty of nature is thus a merciful provision for those beings who know not the meaning of sympathy. In early ages and in savage life it was the same with man. The skulls found in the gravel beds are all full of teeth, as of those who died early. Now, in advanced civilization, love and care prolong life to a great age. This is not an unmixed good. Almost the very existence of slow decay and long disease has been brought about by the love and care that distinguish humanity. Hence it is a peculiarly noble and Christian work to lessen the sufferings that in a sense our own care has made possible; and, as far as we are able, to make old age a period of serene sunshine and an unmixed blessing.—*Leisure Hour.*

Preparing for the World's Fair at Chicago.

A ground plan for the World's Fair buildings has been adopted provisionally, according to which the main structures, twelve in number, will cover 74 acres. The numerous annexes will, it is thought, occupy about 37 acres more. The distribution of space is as follows:

Department.	Main structures. Acres.	Additional area. Acres.	Total acres.
Agriculture	9½	10	19½
Horticulture	8½	..	8½
Fisheries	3	..	3
Mines	6	.	6
Machinery	11½	7	18½
Transportation	7	10¾	17¾
Manufactures, Liberal arts, Ethnology	22½	9	31½
Electricity	6	.	6
Totals	74	36¾	110¾

The live stock exhibit is to be placed at the south end of the park, where 94 acres are reserved for it. In addition to this, twenty acres are devoted to the government. At the north end of the park 90 to 100 acres more are available for State headquarters and numerous purposes not yet defined.

Progress of the American Tin Plate Industry.

We have received from Messrs. Norton & Bros. a specimen of their tin cans made of American tin plates, the manufacture of which they have lately commenced. These cans are made and soldered by machinery. The ornamental labels are printed in colors directly upon the tin and baked upon the same. This firm alone paid over one million of dollars in 1890 for English tin plates. They expect soon to discontinue the importation of the foreign article, as they have nearly finished a complete Siemens steel furnace and rolling mill at Maywood, and will soon make their own steel plates entirely from domestic material and with American labor. The addition of a furnace and rolling mill to the industries of Maywood will greatly benefit the place. There has been an advance in England of the price of tin plates, and the cost here is now $5.50 per box, whereas in July last the English prices were $4.50 per box. Messrs. Norton, however, believe these prices cannot long be maintained in the face of the active progress that is being made in this country to establish tin industries. In fact, they are now offering tin cans at $2 per hundred which last summer were selling at $3 per hundred in Baltimore.

The Home of Influenza.

Professor Tessier, of the medical faculty of Lyons, has returned from Russia, whither he was sent last March to take evidence upon the course of influenza there, and the various conditions of its evolution. He found, according to the *Medical Record*, that influenza is a growth of Russian soil, and, when not a raging malady, is a smouldering one. The way the people live in winter, locked up in heated houses; the flatness of the soil, its consequent bad drainage, and universally sodden condition when the April thaw begins; the filthiness of the farm yards, the village streets, and the rivers, which become suddenly swollen, and on falling leave a putrid mud behind—all conduce to make influenza endemic. Its microbe is, in fact, to be found in this mud. Dr. Tessier calls it a strepto bacillus. What is peculiar in this disease is the alliance with this bacillus of pneumococcus, which also lives in Russian marshes, river mud, and village pools.

Bering, not Behring.

When the czar Peter the Great determined to send out an exploring expedition to ascertain whether Asia and America were united by land, he selected to lead this expedition Captain Commander Ivan Ivanovich Bering. Bering was the son of Jonas Svendsen by his second wife, Anne Pedersdatter Bering, and was born at Horsens, in Jutland, in the summer of 1681. All the Russian and Danish records agree as to the spelling of the family name; both in Danish and in Russian it is Bering. His autograph is always written Bering.

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A New British War Ship.

The Pique, recently launched, is one of the protected second-class twin-screw cruisers provided for by the Naval Defense Act of last year, and is the first of three of the same class that Palmer & Co. are at present building for her Majesty's government. Her dimensions are as follows: Length between perpendiculars, 300 feet; breadth extreme, 43 feet 8 inches; depth moulded, 22 feet 9 inches; displacement, 3,600 tons on a mean draught of 17 feet 6 inches; I. H. P., 9,000; speed, 20 knots. The vessel has two funnels and two pole masts, with a light fore and aft rig. The hull throughout is built of steel, and the bottom of the ship is sheathed with teak 3½ inches in thickness to 2 feet above the water line. The stem, stern post, rudder, and shaft brackets are of phosphor bronze. There is a steel protective deck, which extends the whole length of the vessel. The transverse section of this deck is in the form of a flat arch, the crown of which rises 1 foot above the water line at center of vessel, and slopes down toward the sides to a point 4 feet below the load line. The thickness on the sloping part is 2 inches, and 1 inch on the crown, where are placed under the protective deck the engines and boilers, magazines, steering gear, and other vital parts of the ship. Vertical engines are adopted in the Pique, and, in order to insure protection to the cylinders which project above the projective deck, a belt of armor of solid steel 5 inches in thickness, with 7 inches of teak backing, is fitted round the engine hatchways, between the protective and upper decks. The vessel is divided into a large number of water-tight compartments, and has a double bottom the full extent of engine and boiler space, the continuity of which is carried forward and aft by the water-tight flats forming the magazines, shell rooms, and store rooms of the ship. The bunkers are placed alongside the engines and boilers, and extend to the upper deck. There are two separate engine and boiler rooms.

The armament consists of two 6 inch breech-loading guns, one mounted on the poop and the other on the forecastle, both placed on the middle line; six 4·7 inch quick-firing guns, three on each broadside; eight six-pounder quick-firing guns, one three-pounder gun, and four five-barrel Nordenfelt guns mounted on suitable stations along the sides of the vessel. A nine-pounder gun for boat and field purposes is also secured on deck. In addition to this, four torpodo tubes are fitted—one forward, one aft, and one on each broadside. For controlling the ship in action a conning tower of steel 3 inches thick is fitted on the aft end of the forecastle, inside of which the various telegraph instruments, steering wheel, voice pipes, etc., are placed.

A complete installation of electric light is fitted, including three powerful search lights. The crew numbers 250 hands all told. The propelling machinery consists of two sets of vertical triple expansion engines, having cylinders 33½ inch, 49 inch, 74 inch, and 39 inch stroke. The boilers are five in number. The close stoke hole system of forced draught is introduced, each stoke hole being fitted with two powerful fans worked by separate engines for the supply of air. The coal supply on 17 feet 6 inches draught is 400 tons.

The solid old ironclad Thunderer, which has just been fitted by Messrs. Maudslay, Sons & Field, of Lambeth, with new triple expansion engines of 7,000 horse power, and is now on the eve of undergoing her trials, has received the first four specimens of a gun from which great things are expected.

The new guns, two of which are mounted in each turret—and the turrets are clothed with 14 inch armor plates, which, though only of old fashioned wrought iron, would stand a great deal of hammering—are of 10 inches caliber and 29 tons weight. The total length is 26 feet 10 inches, the projectile weighs 500 pounds, and the full charge of powder is, as is now usual, just half that weight. At a range of 1,000 yards it is calculated to pierce 21 inches of wrought iron plate, while the 12 inch 45 ton gun is only credited with power to perforate a plate thinner by four-tenths of an inch. Besides the Thunderer, the Devastation and the two new second-class battleships, Barfleur and Centurion, are all to be armed with a quartet each of these weapons. They are the heaviest guns yet constructed to be worked by hand power, and it is probable that in their case the extreme limit of size and weight has been reached in this direction. They are mounted on ordinary Vavasseur slides with hydraulic buffers for taking the recoil. The trunnions are accurately balanced on knife edge bearings, but an arrangement is fitted whereby the shock of the gun on the trunnions—should it be fired with sufficient elevation to cause a downward thrust on the excessively delicate knife edge bearings—is transferred to the broad main bearings themselves. This plan facilitates elevating or depressing the gun. The training is done by causing the turrets to revolve, a double set of racks or toothed wheels being fitted round the base of each turret, into which a vertical shaft with pinion is geared. This shaft is worked by a steam engine well down below out of the reach of shot. The turret is also capable of being revolved by hand gear in the event of the turret-turning engine being disabled, but the operation would naturally be slow.

INVENTION IN 1889 A. D. VS. INVENTION B. C.

At the railway stations, ferry houses, and even upon the street corners, there may be found in almost every city and village in the United States automatic vending machines, which, for a nickel, or more or less, will deliver the various goods which they are adapted to sell. The purchaser may procure a newspaper and a cigar to smoke, or, if averse to the use of the weed, he may secure a tablet of chewing gum or a package of sweets. If entertainment is desired, it may be found in the "nickel in the slot" phonograph.

In Europe and America, machines of this class are provided for dealing out potable liquors; bouquets are also furnished in a similar way; and if you desire to know how much you have increased in weight since yesterday, all that need be done is to mount the platform of the nickel in the slot scales, and drop in your coin, and the thing is done. One of the latest achievements in this line is the automatic photographic apparatus, which takes your picture for a nickel, while you wait.

The craze has even gone so far as to apply the principle to the distribution of perfumery. In the railway stations and ferry houses may be found machines which, for a penny, will dole out a drop or two of liquid which passes for perfumery, and which, in many cases, serves as a thin mask for bodily uncleanliness.

These various devices, and many others which we might mention, are regarded as very clever inventions, and have certainly proved successful in many cases in a pecuniary sense.

The last automatic vending machine alluded to is shown in Fig. 2. The perfume reservoir is located in the upper portion of the vase; the tube communicating with the lower part of the reservoir extends through the side of the vase, and is closed at its upper end by a valve attached to one end of the lever, O. The other end of the lever, O, is connected by a rod with the lever, E, the longer arm of this lever being provided with a pan, R, for receiving coin, while the shorter arm of the lever is furnished with a weight for counterbalancing the pan and closing the valve. A curved piece of metal is arranged concentric with the path of the pan, R, and serves to retain the coin dropped into it through the slot in the top of the vase until the pan, R, is carried down beyond the end of the curved plate, when the coin is discharged into the lower part of the vase; the counterweight on the short arm of the lever then returns the lever to the point of starting, and closes the valve, thus stopping the flow of the perfume.

This very clever device was patented by Mr. Lewis C. Noble, of Boston, Mass., on November 19, 1889. Our illustration is prepared directly from the patent drawings. This and other machines for analogous purposes are regarded as the peculiar product of our inventive age, but in turning back the pages of history we find that in Egypt, something more than two thousand years ago, when a worshiper was about to enter the temple, he sprinkled himself with lustral water, taken from a vase near the entrance. The priests made the distribution of holy water a source of revenue by the employment of the automatic vending machine which is illustrated in Fig. 1. This apparatus would not release a single drop of the purifying liquid until coin to the amount required had been deposited in the vase.

A comparison of the ancient lustral water vase and the modern perfumery vending machine will show that they are substantially alike. The ancient machine has a lever, O, fulcrumed in the standard, N, and connected with the valve in the reservoir, H. The lever is furnished with the pan, R, for receiving the coins dropped through the slot, A, at the top of the vase. An enlarged view of the valve belonging to the vase is shown at the left of the engraving.

The mechanism is almost identical with that shown in the modern device, illustrated in Fig. 2; in fact, this ancient vase described by Heron, more than two thousand years ago, is the prototype of all modern automatic vending machines, and simply serves as another proof of the truth of the saying "There is nothing new under the sun."

It is a curious fact that this ancient invention escaped the notice of the Patent Office until long after patents were granted for the earlier automatic vending machines. It was only a comparatively short time ago that the Patent Office began to cite the vase of Heron as a reference. It was discovered in an ancient work on natural philosophy, and it is a matter of considerable interest to us now to know that this device was well known to the Patent Office during the middle of this century. The vase of Heron is illustrated and described in a work on hydraulics and mechanics published in 1850, by Thomas Ewbank, who was at that time Commissioner of Patents.

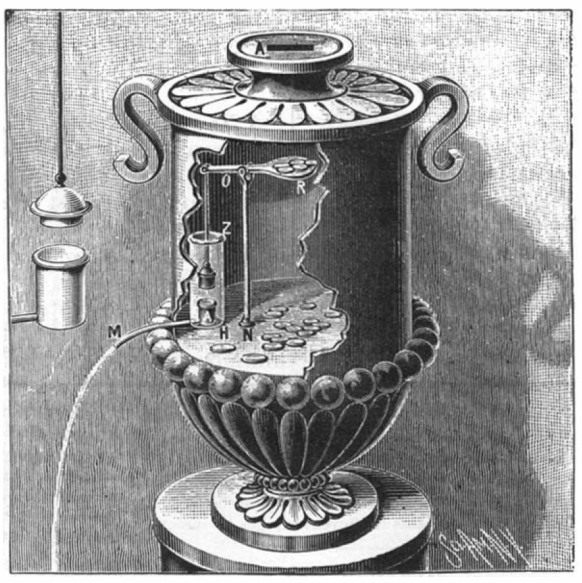

Fig. 1.—LUSTRAL WATER VASE DESCRIBED BY HERON. ABOUT 100 B.C.

Fig. 2.—NOBLE'S AUTOMATIC PERFUME DISTRIBUTOR. PATENTED IN 1889.

Identity by the Thumb.

At a recent meeting of the Anthropological Institute, Mr. Francis Galton, F.R.S., exhibited a large number of impressions of the bulbs of the thumb and fingers of human hands, showing the curves of the capillary ridges on the skin. These impressions are an unfailing mark of the identity of a person, since they do not vary from youth to age, and are different in different individuals. There is a statement that the Chinese—who seem to be credited with every new discovery—had used thumb impressions as proofs of identity for a long time, but Mr. Galton pronounced it to be an egregious error. Impressions of the thumb formed, indeed, a kind of oath or signature among the Chinese, but nothing more. Sir W. J. Herschell, however, when in the Civil Service of India, introduced the practice of imprinting finger marks as a check on personation. Mr. Galton's impressions were taken from over 2,000 persons by spreading a thin film of printers' ink on a plate of glass, then pressing the thumb or finger carefully on the plate to ink the papillary ridges, and afterward printing the latter on a sheet of white paper. Typical forms can be discerned and traced, of which the individual forms are mere varieties. Wide departures from the typical form are very rare.

Our Navy to Aid the Exposition.

Several army and navy officers who have been detailed as special commissioners to carry invitations from the government of the United States to the other American republics and the West Indian colonies have left for their destinations. It will be part of their duties, *Bradstreet's* says, to explain the plan and scope of the exhibition, to secure the appointment of commissioners by the several governments, to give information regarding the regulations for foreign exhibitors and for the admission of goods through the custom house, and to secure characteristic exhibits. The commissioners are particularly instructed to secure exhibits for a commercial section of the Latin-American Department, for the information and instruction of the merchants and manufacturers of the United States, showing the various classes of merchandise consumed and desired by the people of the countries to which they are assigned; the patterns and designs most preferred; the best methods of preparing and packing them; practical illustrations of the obstacles in the way of extending trade, and the advantages that are secured and enjoyed by European merchants in competition with those of the United States.

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How Sugar is Made in Cuba.

The Soledad, Cuba, sugar plantation has the reputation of being the best managed sugar plantation in Cuba. It produced in 1890, 12,000,000 pounds of sugar, and this year it will probably send to market 14,000,000 pounds. Other plantations largely exceed it in cultivated area and mechanical resources, the Consuelo having a product of 40,000,000 pounds, but Soledad is conducted on scientific principles and with American thoroughness, system and organization, so that there is the greatest saving in the cost of production and the largest margin for profit on the investment. All the improved machinery is here; every time-saving and labor-dispensing device is employed, and the maximum amount of sugar is obtained from the cane at the lowest possible cost. Soledad is largely owned by Mr. Atkins, of Boston, but Mr. Murray, the manager, holds a large interest in it. H. J. Abbott, who was for many years a United States government expert and chemist, and who has been most successful in operating plantations here and in Santo Domingo, and in supplying new and improved machinery for them, pronounces Soledad incomparably the best conducted sugar estate in the West Indies.

At Soledad the cane is carried to the works by long trains running on narrow gauge railways through the estate. It is unloaded from the cars by negroes and thrown upon a broad carrier traveling up a long incline to the rollers of the first mill. As many as fifteen men are employed in handling this moving mass of cane. When it reaches the first mill, it is ground by rollers weighing fifteen tons and set close together. The cane is broken up and about 60 per cent of the liquor which it contains is drawn off underneath the mill. Under the old process there was only one grinding, and much of the liquor was wasted. Now the cane is ground twice and an additional 15 per cent of the juice is obtained. Streams of liquor from the vats of the two mills unite and pass through a strainer, one workman being employed in raking off floating refuse and preventing obstructions. The liquor is then ready to be pumped into the boiling works.

The refuse of the cane after the two grindings is the only fuel used in the works. It is carried by moving conductors to the furnaces and dumped automatically, being dried by the intense heat and consumed as rapidly as it is fed. Wood was used as fuel when the steam engine was introduced in sugar works, and subsequently bagasse, or refuse cane, was put with it. Boilers have been invented to facilitate the employment of bagasse as fuel. Those used here are the Porcupine boilers of the Stillwater pattern. The cane, when fed to the conductors, serves to keep all the complex machinery of the works in operation; the broken and crushed fragments of bagasse are carried to the furnaces and furnish the power by which not only the grinding but also the pumping and boiling are done; all that is not juice, but sheer waste, goes into the production of force by which the mills are kept grinding and the liquor clarified, boiled and crystallized into sugar.

From the grinding mill the cane juice is pumped into defecators, or large tanks, in the upper story of the boiling works. In these tanks it is treated with lime, which neutralizes the acid. The albumen coagulates when the cells are broken by steam and brought to the boiling point. From the defecators the liquid is pumped into the first of three great boilers, or vacuum pans. In order that boiling may take place at low temperatures the air in the pans is exhausted by steam pumps. In the first boiler the temperature is 200 degrees, in the second 180 degrees, and in the third 150 degrees, with corresponding vacuums in each, the heat from the boiling liquor being an agency in the process. This is known as the triple effect of boiling. The liquor is boiled to a sirup containing 50 per cent of water and 50 per cent of sugar. The sugar crystallizes in two large strike pans, where the most delicate work of the factory is done. The most expert operatives are in charge of the strike pans, from which the contents are constantly sampled and tested in the laboratory, conducted here by a most intelligent American, J. G. Lumelius. The sugar is rapidly cooled and carried into a series of centrifugals. In these the sugar is separated from the molasses by the centrifugal process. As the contents revolve about the center, the sugar gradually begins to whiten and the molasses is expelled through holes in the sides. When the process is completed, 85 per cent is sugar and 15 per cent molasses as the result of two boilings. The sugar is collected by machinery, carried to the bagging and weighing rooms, and transported by railroad and steam lighter to the wharves of Cienfuegos for shipment to New York.

The works are in operation at Soledad day and night from December to May, and are then closed until the next grinding season. This is the period when the cane is ripe, and when the juice must be expressed with the least possible delay. Cane that is left too long in the field deteriorates in quality and yields less juices. The cane bears one crop a year, and stands for twelve years. When it is ready for harvest it is cut close to the ground with knives and carried to the tramway cars. The next season the cornlike stalk grows to its full height, and is ready to be cut again and to have its juice expressed. The grinding season is a short one, and there is great danger lest the cane be spoiled by heat or rain. The most intelligent supervision is required in the fields, and the most rapid transportation of the cane to the mills. Both of these conditions are supplied at Soledad. The cane is cut when it is ripe and carried by train to the mills, where it is converted into sugar in a single day.—*N. Y. Tribune.*

The Electric Current.

There are but few people who ever stop to think of the great benefits which they enjoy in this world, says *Modern Light and Heat.* We are all too apt to think our own particular case is a hard one, without realizing that no matter how badly off we are, we have a great many things for which we ought to be thankful. And there are few who realize that the electric current plays the important role that it does in our every-day life. Our streets are lighted by electric lamps, which are discouragers of crime and wantonness and protectors of life and property; we have our police signal and our fire alarm systems, to the latter of which we owe a great deal more than is ordinarily realized. We all know to what great risks our property is always exposed from fire, and how great the need is that every precaution should be taken to secure its immediate extinguishment. For this purpose electricity has furnished the most satisfactory solution of the problem. Our cities are covered with a vast network of wires, signal boxes are located at frequent intervals, from which, when need arises, the warning, and the approximate location of the fire is instantaneously transmitted to the places where the fire apparatus is located. In this field the electric current, with human skill and intelligence, and the assistance of trained animals, affords a protection which no other agent could do.

What Horses Die of.

A New York horse life insurance company, insuring only sound and generally young animals, worth between $100 and $400 each, reports that, of 704 horses dying within the past five years, 183 died of colic, 77 of inflammation of the bowels, 74 of kidney trouble, 51 of pneumonia, 52 of sunstroke, 30 of pinkeye, 37 of lockjaw, 23 of broken legs, 12 of epizootic, 10 of heart disease, 4 of blind staggers, 9 killed by runaways, 4 were drowned, 2 were killed by lightning, 128 died of unknown diseases, and only 8 were burned.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Charles E. Marston, Dover, N. H. This is a boiler designed to take up but little room, while presenting large heating surface and adapted to generate steam very rapidly, being composed of a series of tubes, each connected with the water supply and steam dome, a branch pipe extending from each tube and opening into it near the top and bottom.

ALARM FOR BOILERS. — Frank M. Ashley, Brooklyn, N. Y. Connected at the top and bottom with the boiler is a casing in which is a horizontal cock communicating through a pipe with an alarm, there being an inclosed float attached to a rod having at the top a valve working in a seat in the inclosed horizontal body of the cock, the construction being designed to obviate any sticking or failure of the valve.

ELECTRIC MOTOR.—William M. Dresskell, Brainerd, Minn. Combined with the armature coils is an insulating disk carrying series of contact points connected with the armature coils, two three-armed switch arms being placed on the armature shaft, insulated from each other and from the shaft, and adapted to change the connections of the armature from series to parallel or the reverse for currents of different strength, the motor being adapted for direct or alternating currents.

Railway Appliances.

CAR COUPLING.—Theodore M. Fisher and Alexander Slye, Mecca Mills, Ind. Pivoted in angular braces extending from each side of the drawhead is a lever by means of which the coupling pin may be raised from either side of the car when the link is about to enter the drawhead, springs being arranged to draw the lever downward and cause the pin to engage the link, the device being simple, strong and inexpensive.

CABLE RAILWAY. — George W. Bowman, Denver, Col. By this invention two T-rails are arranged alongside each other to form a cable channel, a swinging drawbar carrying a pilot wheel having a central position fitting between the rails and reduced end portions resting on the rails, in combination with drums and a cable, the pilot wheel serving to steady the car and prevent the cable from being drawn out of the channel before passing around a drum on the car.

Mechanical.

SAW SWAGE. — John Hanchett, Big Rapids, Mich. This is a device of simple and durable construction, in which both ends of the anvil die may be used in swaging, and the die can be readily adjusted toward or from the swage die, whereby all wear on the swage end can be readily taken up, and the die can be taken out at any time for dressing up, the device being well adapted for band saws, circular saws, etc.

SAWING MACHINE.—Benjamin E. and Anderson F. Harreld, Hallowell, Kansas. By this invention a main frame is adapted to carry the operating mechanism and receive and hold the material, while a hinged supplemental frame carries the saws, and is adapted to be elevated to allow the wood to be fed to the machine, which is especially adapted to saw cord wood into pieces of uniform length.

BEVEL.—Alfred M. Brown, Worcester, Mass. This is a tool for carpenters and stair builders, for obtaining a single or double bevel, and also to gauge the length and breadth of the work or as a square, the various adjustments being conveniently and expeditiously made.

FRICTION CLUTCH.—Clarence M. Carhart, Plainfield, N. J. Combined with a pulley having a hub flange is a clamping collar engaging the hub and adapted for contact with the flange, there being a fixed sleeve which is engaged by a cam lever pivoted to the collar, and a shifting mechanism connected with the cam lever, whereby a pulley may be expeditiously and effectively connected with and disconnected from a shaft.

TICKET PRINTING MACHINE —Gideon B. Massey, Mamaroneck, N. Y. (deceased, Sarah R. Massey and Stanley A. Bryant, administrators). This is a machine specially designed to print railway tickets, and has a wheel to receive a number of destination plates, provides for the consecutive numbering of tickets sold, for the keeping of a record thereof, and the printing of a corresponding report, giving the tickets sold to each line station, the machine being quickly and easily adjusted, and positive in its action.

CAN CAPPING MACHINE. — Fernand Saunier, Nantes, France. This is a compact and simple machine, of low cost and economically operated, for quickly attaching caps to the bodies of cans without the use of solder or its equivalent, a perfectly air-tight connection being effected, the invention covering a novel construction and combination of parts.

Agricultural.

PRUNING IMPLEMENT. — John Siebel, Oskaloosa, Iowa. A suitable pole is provided with a removable stock carrying a sliding knife, the stock having a toothed spur through which a shear-cutting blade may slide, with other novel features, designed to form a simple, compact implement, which may be effectively operated with ease and rapidity to remove branches or small limbs without injury to the tree.

FRUIT PICKER'S LADDER. — Whiting Arnold, New York City. The ladder is pivoted upon a truck having a windlass, guide pulleys and cables, whereby the ladder may be readily conveyed from tree to tree and conveniently raised and held at any desired inclination without resting against the boughs, the ladder being detachable, so that a longer or shorter ladder may be used, and the picker may work to the best advantage.

INSECT POWDER DISTRIBUTER.—Andy M. Waddill, Jr., Thomastown, La. This invention consists of a handled frame, with a powder box extending through and supported in the frame by springs, the device being specially designed to facilitate the dusting of cotton or other plants to prevent ravages by insects.

Miscellaneous.

SHEARS.—Emil Krusius, Solingen, Germany. By this invention a spring plate is inserted between the members of the shears, the pivot screw passing through an aperture in the plate, to maintain the cutting edges of the blades in proper relation to each other, even when the blades become loose on the pivot.

ICE CREAM FREEZER. — James M. O'Neall, Dallas, Texas. This freezer has a conical outer casing with hinged top and feed hopper, in which is a conical ice receptacle adapted to be conveniently revolved, the cream being taken up and frozen by contact with the revolving cone, from which it is readily removed by a spiral screw conveyer.

METAL CLASPS.—Gardner A. Watkins, Gardner, Mass. This invention relates to a device for assembling metal clasps and holding them in position for use in the process of coupling or splicing splints, cane, etc., in the manufacture of furniture and other articles, and the invention provides means by which the clasps may be automatically fed from the receptacle in which they are held.

HYDRAULIC BEER PUMP. — Joseph L. Shiring, Allegheny, Pa. This invention provides a double-acting pump to force air into casks to discharge the liquid, the pump acting automatically to keep the air up to the standard pressure, means being provided whereby the action of the oppositely moving pistons shall be rendered positive, and they will always operate, irrespective of the muddy condition of the water.

JEWEL CASE. — Hinrich Grohbrugge, New York City. This case is open at one end, and has a spring at the bottom and a latch in one side wall, while a drawer is adapted to engage the spring and latch, the locking mechanism being invisible, and a key not being required to lock or unlock the case.

GATE. — James W. Fisher, Palouse, Washington. This invention provides a novel construction and combination of parts whereby the gate may be conveniently and expeditiously raised when occasion may demand to swing inward and outward over any obstruction, such as drifted snow, etc., while it also has a simple, strong and effective spring latch.

HORSESHOE.—Henry S. Briscoe, Morrisonville, Ill. This is a shoe to be attached to the hoof without the use of nails, a curved clamping bar extending from the sides of the shoe over the hoof, with which is connected an adjustable locking bar extending upward from a lug on the toe of the shoe.

CALENDAR. — Nathan A. Wheeler, Alpowa, Washington. This calendar has the usual stationary numbers, and upon its face are horizontal or perpendicular slides, grooves, or ridges, to support a slip indicating a day, month, or year, the face also having perforations or other provision for holding an indicator thereon, a particular form of frame being provided to encircle a date and prominently display it.

PENCIL HOLDER. — John S. Shaw, Durango, Col. This is a device to be applied to a slate frame, which is made with a longitudinal recess in which is pivoted a spring-actuated receptacle, forming a convenient pocket in which the pencil may be held, and permitting its convenient insertion or removal.

LETTER BOX. — Francis Catudal and Elzear Drolet, Clyde, Kansas. This box has a drop lid opening outwardly, an interior tray opening downwardly, links connecting the lid and tray, a cam lever acting on the lid to open it, and a detent for the lever adapted to hold the lid open temporarily, the box being designed for use by merchants, etc., to receive mail or other matter and hold it safely until removed.

CASH DRAWER AND RECORDER.—William Assheton, Baltimore, Md. This is an improvement in that class of devices in which a strip of paper is caused to move under a partially glazed opening, and the amount of the sale being first written upon the paper, the paper is fed forward under the glass as the drawer is opened to deposit the money, so that the record of the amount cannot be tampered with.

LOCK.—Benjamin Edwards, New York City. This is a lock to which a key cannot be fitted unless the mechanism is exposed, thus preventing the lock from being skeletoned or picked, the lock being also constructed for a variety of keys, so that the key of one lock will not fit another lock differing therefrom in the slightest degree in any of its operative parts.

SHEATHING VESSELS. — Franklin Ewing, Jr., Atlantic Highlands, N. J. This invention covers an apparatus for applying sheathing to hulls, comprising clamping plates or jaws to secure the apparatus to the beam, a lifting screw, and an arm carrying a pressure screw at right angles to the lifting screw, the arm and pressure screw being adjustable to different positions. The invention is also applicable for joining the timbers of the hull, and otherwise facilitating its construction.

ORE WASHER. — Samuel C. McLanahan and William F. Kirk, Hollidaysburg, Penn. This invention consists in the peculiar construction and arrangement of the journals, journal bearings, and end plates of the washer box, whereby the renewal of the bearing surface, when worn, may be more easily effected, and also in the special construction of a flanged journal, a sleeve for the end of the shaft, and stirring blades attached to the sleeve.

OIL CUP. — Charles H. Baker, New York City. This is a device designed more particularly for wagon hubs, the exterior being screw-threaded to screw into the hub, while in the inner cap is a screw rod with a point adapted to close more or less wholly the feed aperture, and thus control the supply of oil to the axle.

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LEAK DETECTOR FOR PIPES.—Andrew H. Brown, New York City. This invention relates to an improvement on a former patented invention of the same inventor, by which the accumulating water actuates a valve so that an annunciator is sounded, the improvement providing for the continuous sounding of the alarm until the leak is repaired.

HEATING AND VENTILATING BUILDINGS.—Donald Andrews, Lockport, N. Y. Air passages are, by this invention, arranged in the walls of the building and connected at their lower ends with a fresh air passage led over coils of incased heating pipes, foul air discharge pipes being also arranged in the walls, and both passages being broken up by numerous small registers, to constantly remove vitiated air and supply pure heated air.

BAIL LOCK.—William Boyrer, New York City. This is a device designed for use on pots, kettles, etc., to hold the handle off the hot body part, and consists of a clamp adapted to clamp on one of the ears and a swinging arm pivoted on the clamp and adapted to engage the bail or handle.

BUCKLE CONNECTION.—Anthony Biesen, Merrill, Iowa. For connecting a buckle and strap this invention provides a plate having its two ends adapted to be bent parallel and clinched together, there being formed integral with the plate a loop or keeper for the free end of the strap, making a strong and cheap way for connecting a buckle and strap without doubling the strap and sewing or riveting it.

HORSESHOE.—Thomas L. Tipton, Jerusalem, Ohio. This invention relates to what are styled "rolling horseshoes," used on the front feet of fast horses, and is made to turn both down and up at the heel, with a slight bevel outward on top from the heel nails back to the point or ends of the heel, to provide for the widening of the hoof's heel ends.

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2. Colored plate representing an attractive residence at Auburn Park, Chicago. Cost $7,000. Floor plans, perspective elevation, etc.
3. Plans and perspective view of a carriage house erected at South Orange, N. J., at a cost of $2,700 complete. H. H. Holly, Esq., architect, New York.
4. A residence at South Orange, N. J. Cost $11,000 complete. Perspective elevation, floor plans, etc. Architect, H. H. Holly, New York.
5. Handsome residence of Gothic design at Germantown, Pa., erected for Mr. B. P. Wilson. Perspective elevation and two floor plans.
6. Cottage in Sophia Avenue, Chicago, estimated cost $2,800. Floor plans and perspective elevation.
7. Perspective elevation and floor plans of a recently erected cottage at Stratford, Conn. Cost $2,700 complete.
8. A colonial residence erected at South Orange, N. J., from plans by Rositter & Wright, architects, New York. Cost $17,000 complete. Perspective elevation and two floor plans.
9. Cottage at Austin, Chicago. Estimated cost $3,700. Floor plans, perspective view, etc.
10. Floor plans and perspective view of an elegant cottage at Austin, Chicago. Cost about $5,000.
11. A corner of a boudoir, designed by J. Armstrong Stenhouse. Half page illustration from a colored drawing, which appeared in the Royal Academy exhibition last year.
12. A picturesque cottage of moderate cost at Austin, Chicago. Two floor plans and perspective elevation. Estimated cost $900.
13. Miscellaneous contents: Jarrah wood.—Biographical sketch of Henry Schliemann, the archæologist.—Bronze castings.—The SCIENTIFIC AMERICAN a help to builders.—American stone fields.—How can iron pulleys be papered?—England's favorite hard woods.—Floors.—Plaster.—Developments of construction.—Corrosion of zinc in contact with brick.—Etching upon glass.—Magnesia in cement.—Our last year's volume.—Improved woodworking machinery, illustrated.—A novel calendar, made of tin.—Broughton self-closing basin cock, illustrated.—The Edson recording pressure gauge.—A new gasoline engine, illustrated.—Universal file handle, illustrated.—The Dunning hot water heater.—Improved conduits for electric wires, illustrated.—A thoroughly built parlor door hanger, illustrated.—California fruit.—Labor-saving appliances for the carpenter and builder, illustrated.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2827) **Amateur asks:** 1. What tools or instruments are needed in the finding or searching for minerals of any kind? A. The daimond drill is used for prospecting on the large scale. A mineralogist for field work needs a hammer and chisel. See our SUPPLEMENT, Nos. 200 and 453. 2. Where is the nearest place to look for minerals, in this vicinity? That is for specimens for a collection. A. Bergen Hill: where any blasting is in progress is a good place. You will find most minerals in the metamorphic and primitive rocks. On Staten Island in the serpentine localities, good specimens are often found. See SUPPLEMENT, Nos. 344, 349, and 363. 3. What are the names and properties of the inclosed minerals? A. No. 1 is slag from some furnace or crucible. No. 2 is gypsum. No. 3 is agate. The U. S. Geological Survey may be addressed on the subject of mineral localities. Good works on mineralogy always give localities. Dana's "Mineralogy" is the *sine qua non* for American collectors. We can supply it for $10. Dana's "Manual" and "Text Book" are $2 and $3.50 respectively.

(2828) **W. A. M. asks:** At what height must I cut a tree off, the height of which is 58 feet, so that the stump will form the perpendicular and the top the hypotenuse of a right-angled triangle, the base of which is 30 feet? A. Let x=altitude and y= hypotenuse of triangle. Then by the conditions of the problem we have: $x+y=58$ (1) $y^2-x^2=30^2$ (2) $\therefore x=58-y$. Substituting this value of x in equation (2) we have $y^2-(58-y)^2=900$.

Reducing, $116y=4264$
$y=36{\cdot}76$ feet
$x=21{\cdot}24$ "

Or the tree must be cut 21·24 feet from the ground.

(2829) **J. G. asks:** 1. Please say how many cables there are laid from Great Britain to America? A. See for full account of transatlantic cables our SUPPLEMENT, No. 747. 2. How long is it supposed to take after you telegraph the first word of a message before it is received, from the nearest point of this side of the Atlantic to the other? A. About three seconds is given as the time of transmission of an electric impulse.

(2830) **J. F. F. asks** how horn comb manufacturers flatten or straighten cow horns, so that dampness will not curl them. A. All manipulation of horn in the way of bending is done by heat and pressure. When bent or straightened hot and kept in shape until cool, dampness will have little or no effect on it. Hot water may be used as the heating agent.

(2831) **J. E. R. asks** for the manufacture of what is known as celluloid collars and cuffs. A. Celluloid collars and cuffs are rolled, stamped or pressed into shape while warm. The exact details of the process are not published. A muslin backing may be used to give grain. The rolls, etc., are kept hot by steam, gas flame, or otherwise. The main portion is a sheet of celluloid charged with zinc oxide.

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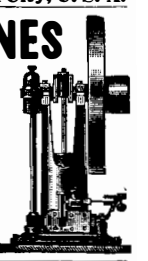

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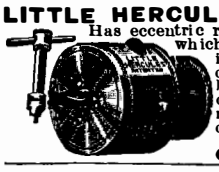

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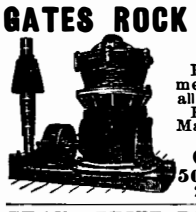

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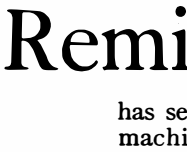

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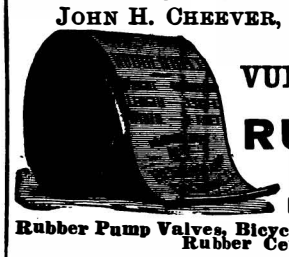

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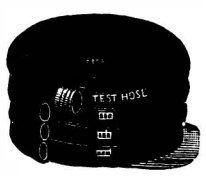

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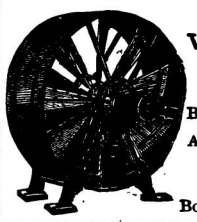

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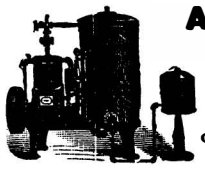

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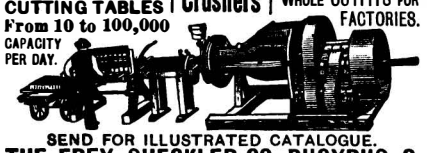

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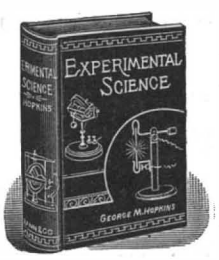

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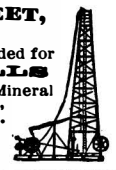

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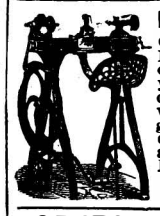

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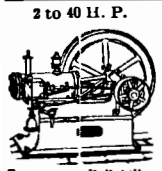

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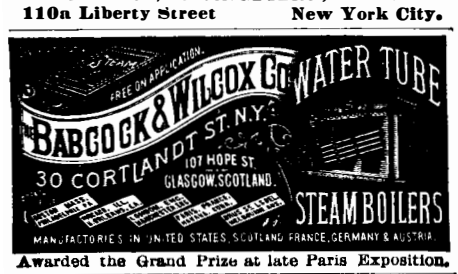
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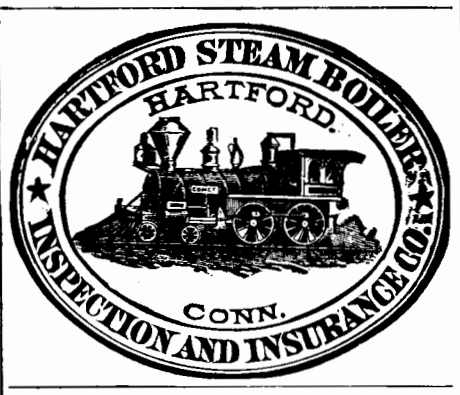

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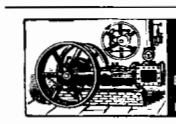

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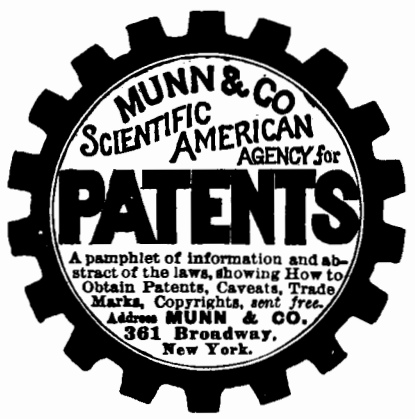
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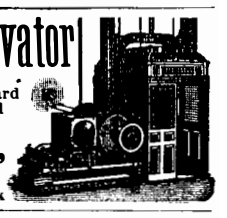

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